United States Department of Agriculture

Natural Resources Conservation Service

United States Department of the Interior

National Park Service

Soil Survey of Tallgrass Prairie National Preserve, Kansas

How To Use This Soil Survey

This publication consists of text, tables, and a map. The text includes descriptions of detailed soil map units and provides an explanation of the information presented in the tables. It also includes a glossary of terms used in the text and tables and a list of references.

The detailed soil map can be useful in planning the use and management of small areas. To find information about your area of interest, locate that area on the map sheet. Note the map unit symbols that are in that area. Go to the Contents, which lists the map units by symbol and name and shows where each map unit is described.

The Contents shows which table has data on a specific land use for each detailed soil map unit. Also see the Contents for sections of this publication that may address your specific needs.

National Cooperative Soil Survey

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

The soil map in this survey may be copied without permission. Enlargement of this map, however, could cause misunderstanding of the detail of mapping. If enlarged, the map does not show the small areas of contrasting soils that could have been shown at a larger scale.

Literature Citation

The correct citation for this survey is as follows:

United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, Park Service. 2013. Soil survey of Tallgrass Prairie National Preserve, Kansas. (Accessible online at: http://soils.usda.gov/survey/printed_surveys/)

Cover Caption

In Tallgrass Prairie National Preserve,Labette and Sogn soils dominate the level uplands (background) and Clime soils are on the gentle side slopes (foreground).

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov/.

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Issued 2013

Preface

This soil survey was developed in conjunction with the National Park Service's Soil Inventory and Monitoring Program and is intended to serve as the official source document for soils occurring within Tallgrass Prairie National Preserve.

This soil survey contains information that affects current and future land use planning in the park. It contains predictions of soil behavior for selected land uses. The survey highlights soil limitations, actions needed to overcome the limitations, and the impact of selected land uses on the environment. It is designed to meet the needs of the National Park Service and its partners to better understand the properties of the soils in the park and the effects of these soil properties on various natural ecological characteristics. This knowledge can help the National Park Service and its partners to understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each map unit is shown on the detailed soil map. Each soil in the survey area is described, and information on specific uses is given. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the park office for Tallgrass Prairie National Preserve.

Soil Survey of Tallgrass Prairie National Preserve, Kansas

United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service

How This Survey Was Made

This soil survey document was prepared in conjunction with the National Park Service's Soil Inventory and Monitoring Program to provide information about the soils and miscellaneous areas within Tallgrass Prairie National Preserve.

The soil survey for Tallgrass Prairie National Preserve was extracted from the county-based soil survey of Chase County, Kansas, which was originally correlated in 1967. The original soil mapping scale was 1:24000. There are 29 soil map units occurring within the park and 100 individual soil map unit components.

The data for the soils in the park was fully certified as part of the Chase County soil survey area on November 29, 2010. Quality assurance was conducted by the NRCS major land resource area office in Salina, Kansas.

During the soil survey, ecological sites and soil component relationships were observed. At the time of assembling the data for this document, the ecological site descriptions were marked as "draft" but were available in the Ecological Site Information System. Soil-site correlation concepts were established to help in designing the map units. Soil and plant specialists tested the concepts during mapping and collected field documentation at numerous points across the landscape.

The information in this report includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only

a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they delineated the boundaries of these bodies on digital imagery and identified each as a specific map unit.

Detailed Soil Map Units

The map units delineated on the detailed soil map in this survey represent the soils or miscellaneous areas in the park. The map unit descriptions in this section, along with the map, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. The soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name

of a soil phase commonly indicates a feature that affects use or management. For example, Chase silty clay loam, occasionally flooded, is a phase of the Chase series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Clime-Sogn complex, 3 to 20 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Gravel pits and quarries is an undifferentiated group in this park.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Borrow pits is an example.

Table 1 lists each map unit in the park, its major and minor components, and the percentage of each component in the unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

1382809—Smolan silty clay loam, 3 to 7 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Smolan and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of Smolan Soil

Classification
Soil taxonomic classification: Fine, smectitic, mesic Pachic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Paleoterraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Slope range: 2 to 6 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Silty and clayey loess
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: High (about 7.8 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 8.9 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 15 inches; silty clay loam
15 to 19 inches; silty clay loam
19 to 42 inches; silty clay
42 to 60 inches; silty clay loam

Minor Components

Irwin soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Tully soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects

Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382810—Chase silty clay loam, occasionally flooded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 740 to 1,400 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Chase and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of Chase Soil

Classification
Soil taxonomic classification: Fine, smectitic, mesic Aquertic Argiudolls
Ecological site name and identification: Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)

Setting
Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Tread
Slope range: 0 to 2 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: High
Parent material: Silty and clayey alluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Depth to water table: About 24 to 48 inches (see table 21)
Drainage class: Somewhat poorly drained
Shrink-swell potential: High (about 8.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.6 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2w
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation

Existing plants: Western ragweed, false indigo, big bluestem, dogbane, Louisiana sagewort, butterfly milkweed, Atlantic wild indigo, hackberry, Illinois bundleflower, Canada wildrye, common spikerush, Virginia wildrye, wild licorice, sawtooth sunflower, Maximilian sunflower, Jerusalem artichoke, black walnut, prairie Junegrass, tall gayfeather, thickspike gayfeather, narrowleaf four o'clock, marsh muhly, Florida paspalum, switchgrass, prairie phlox, bur oak, American elderberry, yellow bristlegrass, wholeleaf rosinweed, compassplant, cup rosinweed, yellow Indiangrass, tall dropseed, prairie cordgrass, buckbrush, eastern gamagrass, wingstem, Baldwin's ironweed, and white crownbeard

Typical Profile

0 to 14 inches; silty clay loam
14 to 20 inches; silty clay loam
20 to 46 inches; silty clay
46 to 60 inches; silty clay

Minor Components

Osage soils

Percent of map unit: 5 percent
Landform: Flood plains
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Across-slope shape: Linear
Meets hydric soil criteria: Yes

Reading soils

Percent of map unit: 5 percent
Landform: Terraces
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Across-slope shape: Linear
Meets hydric soil criteria: No

Aquolls, ponded

Percent of map unit: Less than 1 percent
Landform: Depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382811—Ivan silt loam, channeled

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 95 to 1,200 feet
Mean annual precipitation: 31 to 47 inches

Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Ivan and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of Ivan Soil

Classification
Soil taxonomic classification: Fine-silty, mixed, mesic Cumulic Hapludolls
Ecological site name and identification: Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)

Setting
Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Tread
Slope range: 0 to 3 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: Low
Parent material: Calcareous fine-silty alluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.8 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 5
Available water capacity: High (about 11.1 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 5w
Meets hydric soil criteria: No
Hydrologic soil group: B

Vegetation
Existing plants: Western ragweed, false indigo, big bluestem, dogbane, Louisiana sagewort, butterfly milkweed, Atlantic wild indigo, hackberry, Illinois bundleflower, Canada wildrye, common spikerush, Virginia wildrye, wild licorice, sawtooth sunflower, Maximilian sunflower, Jerusalem artichoke, black walnut, prairie Junegrass, tall gayfeather, thickspike gayfeather, narrowleaf four o'clock, marsh muhly, Florida paspalum, switchgrass, prairie phlox, bur oak, American elderberry, yellow bristlegrass, wholeleaf rosinweed, compassplant, cup rosinweed, yellow Indiangrass, tall dropseed, prairie cordgrass, buckbrush, eastern gamagrass, wingstem, Baldwin's ironweed, and white crownbeard

Typical Profile
0 to 20 inches; silt loam
20 to 35 inches; silty clay loam
35 to 60 inches; silt loam

Minor Components

Reading soils
Percent of map unit: 20 percent
Landform: Terraces
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Meets hydric soil criteria: No

Aquolls
Percent of map unit: Less than 1 percent
Landform: Hillslopes, drainageways, and depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

Aquolls, ponded
Percent of map unit: Less than 1 percent
Landform: Depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382812—Ivan silt loam, occasionally flooded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 95 to 1,200 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 61 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Ivan and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Ivan Soil

Classification
Soil taxonomic classification: Fine-silty, mixed, mesic Cumulic Hapludolls
Ecological site name and identification: Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)

Setting
Landscape: River valleys
Landform: Flood plains

Landform position (three-dimensional): Tread
Slope range: 0 to 2 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: Low
Parent material: Calcareous fine-silty alluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.3 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 5
Available water capacity: High (about 11.6 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2w
Meets hydric soil criteria: No
Hydrologic soil group: B

Vegetation
Existing plants: Western ragweed, false indigo, big bluestem, dogbane, Louisiana sagewort, butterfly milkweed, Atlantic wild indigo, hackberry, Illinois bundleflower, Canada wildrye, common spikerush, Virginia wildrye, wild licorice, sawtooth sunflower, Maximilian sunflower, Jerusalem artichoke, black walnut, prairie Junegrass, tall gayfeather, thickspike gayfeather, narrowleaf four o'clock, marsh muhly, Florida paspalum, switchgrass, prairie phlox, bur oak, American elderberry, yellow bristlegrass, wholeleaf rosinweed, compassplant, cup rosinweed, yellow Indiangrass, tall dropseed, prairie cordgrass, buckbrush, eastern gamagrass, wingstem, Baldwin's ironweed, and white crownbeard

Typical Profile
0 to 17 inches; silt loam
17 to 32 inches; silt loam
32 to 60 inches; silt loam

Minor Components

Kahola soils
Percent of map unit: 8 percent
Landform: Flood plains
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Meets hydric soil criteria: No

Reading soils
Percent of map unit: 7 percent

Landform: Terraces
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Across-slope shape: Linear
Meets hydric soil criteria: No

Osage soils, hydric
Percent of map unit: Less than 1 percent
Landform: Flood plains
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Meets hydric soil criteria: Yes

1382813—Kahola silt loam, rarely flooded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 95 to 1,200 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 61 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Kahola and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Kahola Soil

Classification
Soil taxonomic classification: Fine-silty, mixed, mesic Cumulic Hapludolls
Ecological site name and identification: Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)

Setting
Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Tread
Slope range: 0 to 2 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: Low
Parent material: Fine-silty alluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Depth to water table: More than 72 inches

Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.4 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 3
Available water capacity: High (about 11.8 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2w
Meets hydric soil criteria: No
Hydrologic soil group: B

Vegetation
Existing plants: Western ragweed, false indigo, big bluestem, dogbane, Louisiana sagewort, butterfly milkweed, Atlantic wild indigo, hackberry, Illinois bundleflower, Canada wildrye, common spikerush, Virginia wildrye, wild licorice, sawtooth sunflower, Maximilian sunflower, Jerusalem artichoke, black walnut, prairie Junegrass, tall gayfeather, thickspike gayfeather, narrowleaf four o'clock, marsh muhly, Florida paspalum, switchgrass, prairie phlox, bur oak, American elderberry, yellow bristlegrass, wholeleaf rosinweed, compassplant, cup rosinweed, yellow Indiangrass, tall dropseed, prairie cordgrass, buckbrush, eastern gamagrass, wingstem, Baldwin's ironweed, and white crownbeard

Typical Profile
0 to 17 inches; silt loam
17 to 25 inches; silty clay loam
25 to 35 inches; silt loam
35 to 60 inches; loam

Minor Components

Ivan soils
Percent of map unit: 8 percent
Landform: Flood plains
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Across-slope shape: Linear
Meets hydric soil criteria: No

Reading soils
Percent of map unit: 7 percent
Landform: Terraces
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Across-slope shape: Linear
Meets hydric soil criteria: No

Osage soils, hydric
Percent of map unit: Less than 1 percent
Landform: Flood plains
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Meets hydric soil criteria: Yes

1382816—Clime-Sogn complex, 3 to 20 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,000 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 54 to 61 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Clime and similar soils: 67 percent
Sogn and similar soils: 30 percent
Dissimilar minor components: 3 percent

Description of Clime Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Udorthentic Haplustolls
Ecological site name and identification: Limy Upland (Draft) (PE 30-36) (R076XY012KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Slope range: 3 to 15 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Silty and clayey residuum weathered from calcareous shale
Restrictive feature(s): Paralithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: High (about 8.1 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 23
Available water capacity: Low (about 3.7 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 6e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation

Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, Louisiana sagewort, groundplum milkvetch, heath aster, aromatic aster, narrowleaf milkvetch, silky aster, butterfly milkweed, whorled milkweed, sideoats grama, blue grama, hairy grama, false boneset, buffalograss, serrate-leaf evening primrose, roughleaf dogwood, white prairieclover, roundhead prairie clover, purple prairieclover, silky prairieclover, plains larkspur, Scribner's panicum, blacksamson, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, boneset, rose verbena, stiff sunflower, willowleaf sunflower, roundhead lespedeza, tall gayfeather, dotted gayfeather, plains muhly, ring muhly, common evening primrose, Missouri evening primrose, parthenium, switchgrass, white penstemon, cobaea penstemon, breadroot scurfpea, slimflower scurfpea, fragrant sumac, smooth sumac, prairie rose, fringeleaf ruellia, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, Ohio spiderwort, and Jersey tea

Typical Profile

0 to 9 inches; silty clay
9 to 26 inches; silty clay
26 to 33 inches; silty clay
33 to 37 inches; unweathered bedrock

Description of Sogn Soil

Classification

Soil taxonomic classification: Loamy, mixed, mesic Lithic Haplustolls
Ecological site name and identification: Shallow Limy (Draft) (PE 30-36) (R076XY028KS)

Setting

Landscape: Uplands
Landform: Hillslopes
Landform position (two-dimensional): Summit
Slope range: 3 to 15 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities

Runoff: Medium
Parent material: Loamy residuum weathered from limestone
Restrictive feature(s): Lithic bedrock at a depth of 4 to 20 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Somewhat excessively drained
Shrink-swell potential: Moderate (about 4.8 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Very low (about 1.1 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, field pussytoes, Louisiana sagewort, heath aster, silky aster, sideoats grama, blue grama, hairy grama, buffalograss, Fremont clematis, white prairieclover, purple prairieclover, Scribner's panicum, blacksamson, Leavenworth's eryngo, rose verbena, wild licorice, Maximilian sunflower, willowleaf sunflower, dotted gayfeather, rock muhly, Missouri evening primrose, pricklypear, switchgrass, slender mountainmint, upright prairie coneflower, fragrant sumac, smooth sumac, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, yellow Indiangrass, rigid goldenrod, tall dropseed, buckbrush, purpletop tridens, nettleleaf noseburn, and Jersey tea

Typical Profile
0 to 7 inches; silty clay loam
7 to 11 inches; unweathered bedrock

Minor Components

Rock outcrop
Percent of map unit: 3 percent
Representative aspect: South
Aspect range: All aspects

Aquolls
Percent of map unit: Less than 1 percent
Landform: Drainageways and depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382818—Dwight silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Dwight and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Dwight Soil

Classification
Soil taxonomic classification: Fine, smectitic, mesic Typic Natrustolls
Ecological site name and identification: Sodic Claypan (Draft) (Peer Review) (PE 30-36) (R076XY005KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Crest
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey residuum weathered from cherty limestone
Restrictive feature(s): Lithic bedrock at a depth of 40 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 10.6 LEP)
Salinity maximum: Non saline (about 1.0 mmho/cm)
Sodicity maximum: Sodium adsorption ratio of 9.0
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 5.7 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, western ragweed, big bluestem, plantainleaf pussytoes, Louisiana sagewort, heath aster, sideoats grama, blue grama, buffalograss, woolly verbena, Scribner’s panicum, common spikerush, purple lovegrass, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, little bluestem, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, and tall dropseed

Typical Profile
A—0 to 5 inches; silt loam
Bt—5 to 32 inches; clay
BC—32 to 42 inches; silty clay
R—42 to 46 inches; unweathered bedrock

Minor Components

Labette soils
Percent of map unit: 8 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Irwin soils
Percent of map unit: 7 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382821—Florence-Labette complex, 2 to 12 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 1,000 to 1,495 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Florence and similar soils: 47 percent
Labette and similar soils: 34 percent
Unknown soils: 19 percent

Description of Florence Soil

Classification
Soil taxonomic classification: Clayey-skeletal, smectitic, mesic Udic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 2 to 12 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Clayey residuum weathered from clayey shale and/or clayey residuum weathered from cherty limestone
Restrictive feature(s): Lithic bedrock at a depth of 40 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)

Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Very low (about 0.9 inch)

Interpretive Groups
Land capability subclass (nonirrigated): 6e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 3 inches; gravelly silt loam
3 to 13 inches; extremely gravelly silt loam
13 to 20 inches; extremely gravelly silty clay loam
20 to 42 inches; extremely cobbly clay
42 to 46 inches; unweathered bedrock

Description of Labette Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Udic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 2 to 8 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches

Drainage class: Well drained
Shrink-swell potential: Very high (about 13.1 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 4.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 10 inches; silty clay loam
10 to 15 inches; silty clay loam
15 to 34 inches; silty clay
34 to 38 inches; silty clay
38 to 42 inches; unweathered bedrock

1382822—Florence-Matfield cherty silt loams, 1 to 15 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 74—Central Kansas Sandstone Hills
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Florence and similar soils: 70 percent
Matfield and similar soils: 25 percent
Dissimilar minor components: 5 percent

Description of Florence Soil

Classification
Soil taxonomic classification: Clayey-skeletal, smectitic, mesic Udic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 2 to 15 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Clayey residuum weathered from clayey shale and/or clayey residuum weathered from cherty limestone
Restrictive feature(s): Lithic bedrock at a depth of 40 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Very low (about 0.9 inch)

Interpretive Groups
Land capability subclass (nonirrigated): 6e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 3 inches; gravelly silt loam
3 to 13 inches; extremely gravelly silt loam
13 to 20 inches; extremely gravelly silty clay loam
20 to 42 inches; extremely cobbly clay
42 to 46 inches; unweathered bedrock

Description of Matfield Soil

Classification
Soil taxonomic classification: Clayey-skeletal, smectitic, mesic Pachic Paleustolls
Ecological site name and identification: Flint Ridge (Draft) (PE 30-36) (R076XY009KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 1 to 5 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Clayey residuum weathered from cherty limestone
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Low (about 1.8 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 3.8 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 6e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, Louisiana sagewort, groundplum milkvetch, heath aster, aromatic aster, blue wild indigo, plains wild indigo, sideoats grama, blue grama, hairy grama, buffalograss, serrate-leaf evening primrose, white prairieclover, purple prairieclover, Scribner's panicum, blacksamson, Canada wildrye, common spikerush, Virginia wildrye, stiff sunflower, prairie Junegrass, dotted gayfeather, Missouri evening primrose, switchgrass, slimflower scurfpea, upright prairie coneflower, catclaw sensitive-briar, little bluestem, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, and Jersey tea

Typical Profile
0 to 12 inches; gravelly silt loam
12 to 22 inches; extremely gravelly silt loam
22 to 46 inches; extremely gravelly silt loam
46 to 60 inches; extremely cobbly clay

Minor Components

Labette soils
Percent of map unit: 3 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Dwight soils
Percent of map unit: 2 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382823—Irwin silty clay loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Irwin and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Irwin Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Pachic Argiustolls
Ecological site name and identification: Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Interfluve
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey residuum weathered from clayey shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 12.3 LEP)
Salinity maximum: Not saline
Sodicity maximum: Sodium adsorption ratio of 2.0
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 8.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, dogbane, Louisiana sagewort, groundplum milkvetch, aromatic aster, green antelopehorn, blue wild indigo, sideoats grama, blue grama, buffalograss, woolly verbena, plains larkspur, Illinois bundleflower, Scribner's panicum, Canada wildrye, common spikerush, purple lovegrass, wild licorice, Maximilian sunflower, prairie Junegrass, roundhead lespedeza, tall gayfeather, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, pitcher sage, catclaw sensitive-briar, little bluestem, prairie groundsel, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, eastern gamagrass, and Baldwin's ironweed

Typical Profile
0 to 11 inches; silty clay loam
11 to 38 inches; silty clay
38 to 53 inches; silty clay
53 to 60 inches; silty clay

Minor Components

Dwight soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Labette soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent

Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Ladysmith soils
Percent of map unit: 5 percent
Landform: Paleoterraces
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Meets hydric soil criteria: No

Aquolls
Percent of map unit: Less than 1 percent
Landform: Drainageways and depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382824—Irwin silty clay loam, 1 to 3 percent slopes, eroded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Irwin, eroded and similar soils: 95 percent
Dissimilar minor components: 5 percent

Description of Irwin Soil, Eroded

Classification
Soil taxonomic classification: Fine, mixed, mesic Pachic Argiustolls
Ecological site name and identification: Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Interfluve
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey residuum weathered from clayey shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 12.3 LEP)
Salinity maximum: Not saline
Sodicity maximum: Sodium adsorption ratio of 2.0
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 7.8 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, dogbane, Louisiana sagewort, groundplum milkvetch, aromatic aster, green antelopehorn, blue wild indigo, sideoats grama, blue grama, buffalograss, woolly verbena, plains larkspur, Illinois bundleflower, Scribner's panicum, Canada wildrye, common spikerush, purple lovegrass, wild licorice, Maximilian sunflower, prairie Junegrass, roundhead lespedeza, tall gayfeather, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, pitcher sage, catclaw sensitive-briar, little bluestem, prairie groundsel, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, eastern gamagrass, and Baldwin's ironweed

Typical Profile
0 to 5 inches; silty clay loam
5 to 38 inches; silty clay
38 to 53 inches; silty clay
53 to 60 inches; silty clay

Minor Components

Dwight soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Aquolls
Percent of map unit: Less than 1 percent
Landform: Drainageways and depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382825—Irwin silty clay loam, 3 to 7 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Irwin and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of Irwin Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Pachic Argiustolls
Ecological site name and identification: Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Base slope
Slope range: 3 to 5 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey residuum weathered from clayey shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 12.3 LEP)
Salinity maximum: Not saline
Sodicity maximum: Sodium adsorption ratio of 2.0
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Moderate (about 8.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, dogbane, Louisiana sagewort, groundplum milkvetch, aromatic aster, green antelopehorn, blue wild indigo, sideoats grama, blue grama, buffalograss, woolly verbena, plains

larkspur, Illinois bundleflower, Scribner's panicum, Canada wildrye, common spikerush, purple lovegrass, wild licorice, Maximilian sunflower, prairie Junegrass, roundhead lespedeza, tall gayfeather, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, pitcher sage, catclaw sensitive-briar, little bluestem, prairie groundsel, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, eastern gamagrass, and Baldwin's ironweed

Typical Profile
0 to 11 inches; silty clay loam
11 to 38 inches; silty clay
38 to 53 inches; silty clay
53 to 60 inches; silty clay

Minor Components

Tully soils
Percent of map unit: 10 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Aquolls
Percent of map unit: Less than 1 percent
Landform: Drainageways and depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382826—Irwin silty clay loam, 3 to 7 percent slopes, eroded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 1,000 to 1,600 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Irwin, eroded and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of Irwin Soil, Eroded

Classification
Soil taxonomic classification: Fine, mixed, mesic Pachic Argiustolls
Ecological site name and identification: Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Base slope
Slope range: 3 to 5 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey residuum weathered from clayey shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 11.6 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: High (about 9.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, dogbane, Louisiana sagewort, groundplum milkvetch, aromatic aster, green antelopehorn, blue wild indigo, sideoats grama, blue grama, buffalograss, woolly verbena, plains larkspur, Illinois bundleflower, Scribner's panicum, Canada wildrye, common spikerush, purple lovegrass, wild licorice, Maximilian sunflower, prairie Junegrass, roundhead lespedeza, tall gayfeather, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, pitcher sage, catclaw sensitive-briar, little bluestem, prairie groundsel, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, eastern gamagrass, and Baldwin's ironweed

Typical Profile
0 to 4 inches; silty clay loam
4 to 53 inches; silty clay
53 to 60 inches; silty clay

Minor Components

Tully soils
Percent of map unit: 10 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects

Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Aquolls
Percent of map unit: Less than 1 percent
Landform: Drainageways and depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382827—Labette silty clay loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Labette and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Labette Soil

Classification
Soil taxonomic classification: Fine, mixed, superactive, mesic Udic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Crest
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Medium
Parent material: Silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Very high (about 13.1 LEP)

Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 4.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
A—0 to 10 inches; silty clay loam
BA—10 to 15 inches; silty clay loam
Bt—15 to 34 inches; silty clay
BC—34 to 38 inches; silty clay
R—38 to 42 inches; unweathered bedrock

Minor Components

Dwight soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Irwin soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Ladysmith soils
Percent of map unit: 5 percent
Landform: Paleoterraces
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South

Aspect range: All aspects
Slope range: 0 to 1 percent
Meets hydric soil criteria: No

1382828—Labette silty clay loam, 3 to 7 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Labette and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Labette Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Udic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Head slope
Slope range: 3 to 5 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Medium
Parent material: Silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Very high (about 13.1 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 4.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation

Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile

0 to 10 inches; silty clay loam
10 to 15 inches; silty clay loam
15 to 34 inches; silty clay
34 to 38 inches; silty clay
38 to 42 inches; unweathered bedrock

Minor Components

Irwin soils

Percent of map unit: 8 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Dwight soils

Percent of map unit: 7 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382830—Labette-Dwight complex, 0 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Labette and similar soils: 50 percent

Dwight and similar soils: 41 percent
Dissimilar minor components: 9 percent

Description of Labette Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Udic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Interfluve
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Medium
Parent material: Silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Very high (about 13.1 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 4.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 10 inches; silty clay loam

10 to 15 inches; silty clay loam
15 to 34 inches; silty clay
34 to 38 inches; silty clay
38 to 42 inches; unweathered bedrock

Description of Dwight Soil

Classification
Soil taxonomic classification: Fine, smectitic, mesic Typic Natrustolls
Ecological site name and identification: Sodic Claypan (Draft) (Peer Review) (PE 30-36) (R076XY005KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Interfluve
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey residuum weathered from cherty limestone
Restrictive feature(s): Lithic bedrock at a depth of 40 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 10.6 LEP)
Salinity maximum: Non saline (about 1.0 mmho/cm)
Sodicity maximum: Sodium adsorption ratio of 9.0
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 5.7 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4s
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, western ragweed, big bluestem, plantainleaf pussytoes, Louisiana sagewort, heath aster, sideoats grama, blue grama, buffalograss, woolly verbena, Scribner’s panicum, common spikerush, purple lovegrass, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, little bluestem, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, and tall dropseed

Typical Profile
A—0 to 5 inches; silt loam
Bt—5 to 32 inches; clay
BC—32 to 42 inches; silty clay
R—42 to 46 inches; unweathered bedrock

Minor Components

Irwin soils
Percent of map unit: 3 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Ladysmith soils
Percent of map unit: 3 percent
Landform: Paleoterraces
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Meets hydric soil criteria: No

Zaar soils
Percent of map unit: 3 percent
Landform: Hillslopes
Geomorphic position (two-dimensional): Backslope
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382831—Labette-Sogn silty clay loams, 0 to 8 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Labette and similar soils: 47 percent
Sogn and similar soils: 38 percent
Dissimilar minor components: 15 percent

Description of Labette Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Udic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Interfluve
Slope range: 2 to 8 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): Lithic bedrock at a depth of 20 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Very high (about 13.1 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 4.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 6e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 10 inches; silty clay loam
10 to 15 inches; silty clay loam
15 to 34 inches; silty clay
34 to 38 inches; silty clay
38 to 42 inches; unweathered bedrock

Description of Sogn Soil

Classification
Soil taxonomic classification: Loamy, mixed, mesic Lithic Haplustolls

Ecological site name and identification: Shallow Limy (Draft) (PE 30-36) (R076XY028KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 2 to 12 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Medium
Parent material: Loamy residuum weathered from limestone
Restrictive feature(s): Lithic bedrock at a depth of 4 to 20 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.8 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Very low (about 0.9 inch)

Interpretive Groups
Land capability subclass (nonirrigated): 7e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, field pussytoes, Louisiana sagewort, heath aster, silky aster, sideoats grama, blue grama, hairy grama, buffalograss, Fremont clematis, white prairieclover, purple prairieclover, Scribner's panicum, blacksamson, Leavenworth's eryngo, rose verbena, wild licorice, Maximilian sunflower, willowleaf sunflower, dotted gayfeather, rock muhly, Missouri evening primrose, pricklypear, switchgrass, slender mountainmint, upright prairie coneflower, fragrant sumac, smooth sumac, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, yellow Indiangrass, rigid goldenrod, tall dropseed, buckbrush, purpletop tridens, nettleleaf noseburn, and Jersey tea

Typical Profile
0 to 6 inches; silty clay loam
6 to 10 inches; unweathered bedrock

Minor Components

Florence soils
Percent of map unit: 8 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South

Aspect range: All aspects
Slope range: 2 to 12 percent
Meets hydric soil criteria: No

Dwight soils
Percent of map unit: 7 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Aquolls
Percent of map unit: Less than 1 percent
Landform: Drainageways and depressions
Representative aspect: South
Aspect range: All aspects
Down-slope shape: Concave
Across-slope shape: Concave
Meets hydric soil criteria: Yes

1382833—Tully cherty silty clay loam, 5 to 15 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 1,695 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Tully and similar soils: 70 percent
Dissimilar minor components: 30 percent

Description of Tully Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Pachic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 5 to 15 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic

Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Clayey colluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Very high (about 9.7 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 4.8 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 14 inches; gravelly silty clay loam
14 to 19 inches; gravelly silty clay loam
19 to 49 inches; gravelly silty clay
49 to 60 inches; gravelly silty clay

Minor Components

Clime soils
Percent of map unit: 15 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 25 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Martin soils
Percent of map unit: 15 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Base slope

Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 6 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382834—Tully silty clay loam, 3 to 7 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Tully and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Tully Soil

Classification
Soil taxonomic classification: Fine, mixed, mesic Pachic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 3 to 7 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Clayey colluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Very high (about 9.6 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 5.6 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e

Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 14 inches; silty clay loam
14 to 19 inches; silty clay loam
19 to 49 inches; silty clay
49 to 60 inches; silty clay

Minor Components

Irwin soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Martin soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Base slope
Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 6 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Smolan soils
Percent of map unit: 3 percent
Landform: Paleoterraces
Geomorphic position (two-dimensional): Summit
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 6 percent
Across-slope shape: Convex
Meets hydric soil criteria: No

Dwight soils
Percent of map unit: 2 percent

Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382835—Tully silty clay loam, 3 to 7 percent slopes, eroded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Tully, eroded and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Tully Soil, Eroded

Classification
Soil taxonomic classification: Fine, mixed, mesic Pachic Argiustolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Slope range: 3 to 7 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: High
Parent material: Clayey colluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Very high (about 9.6 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 4.9 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 5 inches; silty clay loam
5 to 10 inches; silty clay loam
10 to 40 inches; silty clay
40 to 60 inches; silty clay

Minor Components

Irwin soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Martin soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Base slope
Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 6 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Smolan soils
Percent of map unit: 3 percent
Landform: Paleoterraces
Geomorphic position (two-dimensional): Summit
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 6 percent
Across-slope shape: Convex
Meets hydric soil criteria: No

Dwight soils
Percent of map unit: 2 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382836—Reading silt loam, rarely flooded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 740 to 1,400 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 61 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Reading and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Reading Soil

Classification
Soil taxonomic classification: Fine-silty, mixed, mesic Pachic Argiudolls
Ecological site name and identification: Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)

Setting
Landscape: River valleys
Landform: Terraces
Landform position (three-dimensional): Tread
Slope range: 0 to 1 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: Low
Parent material: Silty alluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: Rare
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: High (about 9.2 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 1
Meets hydric soil criteria: No
Hydrologic soil group: B

Vegetation
Existing plants: Western ragweed, false indigo, big bluestem, dogbane, Louisiana sagewort, butterfly milkweed, Atlantic wild indigo, hackberry, Illinois bundleflower, Canada wildrye, common spikerush, Virginia wildrye, wild licorice, sawtooth sunflower, Maximilian sunflower, Jerusalem artichoke, black walnut, prairie Junegrass, tall gayfeather, thickspike gayfeather, narrowleaf four o'clock, marsh muhly, Florida paspalum, switchgrass, prairie phlox, bur oak, American elderberry, yellow bristlegrass, wholeleaf rosinweed, compassplant, cup rosinweed, yellow Indiangrass, tall dropseed, prairie cordgrass, buckbrush, eastern gamagrass, wingstem, Baldwin's ironweed, and white crownbeard

Typical Profile
0 to 8 inches; silt loam
8 to 17 inches; silty clay loam
17 to 24 inches; silty clay loam
24 to 48 inches; silty clay loam
48 to 60 inches; silty clay loam

Minor Components

Kahola soils
Percent of map unit: 8 percent
Landform: Flood plains
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Meets hydric soil criteria: No

Chase soils
Percent of map unit: 7 percent
Landform: Flood plains
Geomorphic position (three-dimensional): Tread
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Meets hydric soil criteria: No

Osage soils, hydric
Percent of map unit: Less than 1 percent
Landform: Flood plains
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Meets hydric soil criteria: Yes

1382837—Reading silt loam, 1 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 740 to 1,600 feet
Mean annual precipitation: 31 to 47 inches

Mean annual air temperature: 52 to 61 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Reading and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of Reading Soil

Classification

Soil taxonomic classification: Fine-silty, mixed, mesic Pachic Argiudolls
Ecological site name and identification: Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)

Setting

Landscape: River valleys
Landform: Terraces
Landform position (three-dimensional): Tread
Slope range: 1 to 3 percent
Down-slope shape: Linear
Across-slope shape: Linear
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities

Runoff: Medium
Parent material: Silty alluvium
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: Rare
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Well drained
Shrink-swell potential: Moderate (about 4.5 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: High (about 9.2 inches)

Interpretive Groups

Land capability subclass (nonirrigated): 2e
Meets hydric soil criteria: No
Hydrologic soil group: B

Vegetation

Existing plants: Western ragweed, false indigo, big bluestem, dogbane, Louisiana sagewort, butterfly milkweed, Atlantic wild indigo, hackberry, Illinois bundleflower, Canada wildrye, common spikerush, Virginia wildrye, wild licorice, sawtooth sunflower, Maximilian sunflower, Jerusalem artichoke, black walnut, prairie Junegrass, tall gayfeather, thickspike gayfeather, narrowleaf four o'clock, marsh muhly, Florida paspalum, switchgrass, prairie phlox, bur oak, American elderberry, yellow bristlegrass, wholeleaf rosinweed, compassplant, cup rosinweed, yellow Indiangrass, tall dropseed, prairie cordgrass, buckbrush, eastern gamagrass, wingstem, Baldwin's ironweed, and white crownbeard

Typical Profile
0 to 8 inches; silt loam
8 to 17 inches; silty clay loam
17 to 24 inches; silty clay loam
24 to 48 inches; silty clay loam
48 to 60 inches; silty clay loam

Minor Components

Tully soils
Percent of map unit: 10 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Osage soils, hydric
Percent of map unit: Less than 1 percent
Landform: Flood plains
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 2 percent
Meets hydric soil criteria: Yes

1382839—Martin silty clay loam, 3 to 7 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 800 to 1,695 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Martin and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Martin Soil

Classification
Soil taxonomic classification: Fine, smectitic, mesic Aquertic Argiudolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Base slope
Slope range: 2 to 6 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects

Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: High
Parent material: Silty and clayey colluvium derived from limestone and shale over silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: High (about 6.8 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 1
Available water capacity: Moderate (about 7.0 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 15 inches; silty clay loam
15 to 43 inches; silty clay
43 to 56 inches; silty clay
56 to 60 inches; clay

Minor Components

Clime soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 25 percent
Meets hydric soil criteria: No

Tully soils
Percent of map unit: 5 percent
Landform: Hillslopes

Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Zaar soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (two-dimensional): Backslope
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382840—Martin silty clay loam, 3 to 7 percent slopes, eroded

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 800 to 1,695 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Martin, eroded and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Martin Soil, Eroded

Classification
Soil taxonomic classification: Fine, smectitic, mesic Aquertic Argiudolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Base slope
Slope range: 2 to 6 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: High

Parent material: Silty and clayey colluvium derived from limestone and shale over silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: High (about 8.2 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 1
Available water capacity: Moderate (about 6.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 5 inches; silty clay loam
5 to 33 inches; silty clay
33 to 46 inches; silty clay
46 to 60 inches; clay

Minor Components

Clime soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 25 percent
Meets hydric soil criteria: No

Tully soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent

Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Zaar soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (two-dimensional): Backslope
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382841—Martin-Gullied land complex, 3 to 10 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 800 to 1,695 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Martin, eroded and similar soils: 80 percent
Gullied land: 20 percent

Description of Martin Soil, Eroded

Classification
Soil taxonomic classification: Fine, smectitic, mesic Aquertic Argiudolls
Ecological site name and identification: Loamy Upland (Draft) (PE 30-36) (R076XY015KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Base slope
Slope range: 3 to 10 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Udic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey colluvium derived from limestone and shale over silty and clayey residuum weathered from limestone and shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None

Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: High (about 8.2 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 1
Available water capacity: Moderate (about 6.4 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 6e
Meets hydric soil criteria: No
Hydrologic soil group: C

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, heath aster, aromatic aster, sideoats grama, blue grama, buffalograss, woolly verbena, white prairieclover, purple prairieclover, plains larkspur, Illinois bundleflower, Scribner's panicum, clasping coneflower, pale echinacea, Canada wildrye, common spikerush, Virginia wildrye, purple lovegrass, button snakeroot eryngo, hairy sunflower, stiff sunflower, willowleaf sunflower, prairie Junegrass, roundhead lespedeza, slender lespedeza, tall gayfeather, dotted gayfeather, switchgrass, cobaea penstemon, upright prairie coneflower, grayhead prairie coneflower, fringeleaf ruellia, blackeyed Susan, pitcher sage, catclaw sensitive-briar, little bluestem, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, Virginia tephrosia, eastern gamagrass, Baldwin's ironweed, inland ironweed, and Jersey tea

Typical Profile
0 to 5 inches; silty clay loam
5 to 33 inches; silty clay
33 to 46 inches; silty clay
46 to 60 inches; clay

Description of Gullied Land

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects

Properties and Qualities
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0

Minor Components

Clime soils
Percent of map unit: Less than 1 percent

Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 25 percent
Meets hydric soil criteria: No

Zaar soils
Percent of map unit: Less than 1 percent
Landform: Hillslopes
Geomorphic position (two-dimensional): Backslope
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 7 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382845—Zaar silty clay, 3 to 7 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Zaar and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of Zaar Soil

Classification
Soil taxonomic classification: Fine, smectitic, thermic Vertic Hapludolls
Ecological site name and identification: Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Slope range: 3 to 7 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Udic

Properties and Qualities
Runoff: Very high
Parent material: Ancient alluvium and/or clayey colluvium and/or residuum weathered from shale

Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: About 12 to 24 inches (see table 21)
Drainage class: Somewhat poorly drained
Shrink-swell potential: Very high (about 18.2 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 6
Available water capacity: Moderate (about 8.3 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, dogbane, Louisiana sagewort, groundplum milkvetch, aromatic aster, green antelopehorn, blue wild indigo, sideoats grama, blue grama, buffalograss, woolly verbena, plains larkspur, Illinois bundleflower, Scribner's panicum, Canada wildrye, common spikerush, purple lovegrass, wild licorice, Maximilian sunflower, prairie Junegrass, roundhead lespedeza, tall gayfeather, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, pitcher sage, catclaw sensitive-briar, little bluestem, prairie groundsel, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, eastern gamagrass, and Baldwin's ironweed

Typical Profile
0 to 15 inches; silty clay
15 to 54 inches; silty clay
54 to 60 inches; very parachannery silty clay

Minor Components

Clime soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 25 percent
Meets hydric soil criteria: No

Dwight soils
Percent of map unit: 5 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Crest
Representative aspect: South
Aspect range: All aspects
Slope range: 1 to 3 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

Martin soils
Percent of map unit: 5 percent
Landform: Hillslopes

Geomorphic position (three-dimensional): Base slope
Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 6 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382846—Zaar-Dwight complex, 1 to 3 percent slopes

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Elevation: 800 to 2,595 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Zaar and similar soils: 55 percent
Dwight and similar soils: 45 percent

Description of Zaar Soil

Classification
Soil taxonomic classification: Fine, smectitic, thermic Vertic Hapludolls
Ecological site name and identification: Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Thermic
Soil temperature regime: Thermic
Soil moisture class: Udic

Properties and Qualities
Runoff: Very high
Parent material: Ancient alluvium and/or clayey colluvium and/or residuum weathered from shale
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: About 12 to 24 inches (see table 21)
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 18.2 LEP)
Salinity maximum: Not saline
Sodicity maximum: Not sodic

Calcium carbonate equivalent (maximum weight percentage): 6
Available water capacity: Moderate (about 8.3 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, leadplant, western ragweed, big bluestem, dogbane, Louisiana sagewort, groundplum milkvetch, aromatic aster, green antelopehorn, blue wild indigo, sideoats grama, blue grama, buffalograss, woolly verbena, plains larkspur, Illinois bundleflower, Scribner's panicum, Canada wildrye, common spikerush, purple lovegrass, wild licorice, Maximilian sunflower, prairie Junegrass, roundhead lespedeza, tall gayfeather, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, pitcher sage, catclaw sensitive-briar, little bluestem, prairie groundsel, compassplant, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, tall dropseed, porcupinegrass, eastern gamagrass, and Baldwin's ironweed

Typical Profile
0 to 15 inches; silty clay
15 to 54 inches; silty clay
54 to 60 inches; very parachannery silty clay

Description of Dwight Soil

Classification
Soil taxonomic classification: Fine, smectitic, mesic Typic Natrustolls
Ecological site name and identification: Sodic Claypan (Draft) (Peer Review) (PE 30-36) (R076XY005KS)

Setting
Landscape: Uplands
Landform: Hillslopes
Landform position (three-dimensional): Crest
Slope range: 1 to 3 percent
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: South
Aspect range: All aspects
Soil temperature class: Mesic
Soil temperature regime: Mesic
Soil moisture class: Ustic

Properties and Qualities
Runoff: Very high
Parent material: Silty and clayey residuum weathered from cherty limestone
Restrictive feature(s): Lithic bedrock at a depth of 40 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Moderately well drained
Shrink-swell potential: Very high (about 10.6 LEP)
Salinity maximum: Non saline (about 1.0 mmho/cm)
Sodicity maximum: Sodium adsorption ratio of 9.0
Calcium carbonate equivalent (maximum weight percentage): 0
Available water capacity: Low (about 5.7 inches)

Interpretive Groups
Land capability subclass (nonirrigated): 4s
Meets hydric soil criteria: No
Hydrologic soil group: D

Vegetation
Existing plants: Western yarrow, western ragweed, big bluestem, plantainleaf pussytoes, Louisiana sagewort, heath aster, sideoats grama, blue grama, buffalograss, woolly verbena, Scribner's panicum, common spikerush, purple lovegrass, dotted gayfeather, western wheatgrass, switchgrass, slimflower scurfpea, upright prairie coneflower, little bluestem, Missouri goldenrod, yellow Indiangrass, rigid goldenrod, and tall dropseed

Typical Profile
A—0 to 5 inches; silt loam
Bt—5 to 32 inches; clay
BC—32 to 42 inches; silty clay
R—42 to 46 inches; unweathered cherty limestone

Minor Components

Clime soils
Percent of map unit: Less than 1 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Side slope
Representative aspect: South
Aspect range: All aspects
Slope range: 3 to 25 percent
Meets hydric soil criteria: No

Ladysmith soils
Percent of map unit: Less than 1 percent
Landform: Paleoterraces
Geomorphic position (three-dimensional): Interfluve
Representative aspect: South
Aspect range: All aspects
Slope range: 0 to 1 percent
Meets hydric soil criteria: No

Martin soils
Percent of map unit: Less than 1 percent
Landform: Hillslopes
Geomorphic position (three-dimensional): Base slope
Representative aspect: South
Aspect range: All aspects
Slope range: 2 to 6 percent
Across-slope shape: Linear and convex
Meets hydric soil criteria: No

1382849—Borrow pits

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 41 to 64 degrees F
Frost-free period: 175 to 215 days

Map Unit Composition

Borrow pits: 100 percent

Description of Pits

Setting
Landform position (two-dimensional): Summit, backslope, and shoulder
Landform position (three-dimensional): Side slope and head slope
Down-slope shape: Convex
Across-slope shape: Convex
Representative aspect: North

1382850—Gravel pits and quarries

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills and 112—Cherokee Prairies
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 68 degrees F
Frost-free period: 190 to 225 days

Map Unit Composition

Gravel pits and quarries: 100 percent

Description of Pits

Properties and Qualities
Restrictive feature(s): None within a depth of 60 inches
Frequency of flooding: None
Frequency of ponding: None
Depth to water table: More than 72 inches
Drainage class: Excessively drained
Salinity maximum: Not saline
Sodicity maximum: Not sodic
Calcium carbonate equivalent (maximum weight percentage): 0

1382851—Miscellaneous water

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills

Map Unit Composition

Miscellaneous water: 100 percent

1382852—Water

Map Unit Setting

Major land resource area (MLRA): 76—Bluestem Hills, 74—Central Kansas Sandstone Hills, and 112—Cherokee Prairies

Map Unit Composition

Water: 100 percent

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in Tallgrass Prairie National Preserve. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils as rangeland and as sites for buildings, sanitary facilities, highways and other transportation systems, and recreational facilities. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the park. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, and trees and shrubs.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the park for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, slightly limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately well suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact

on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA-SCS, 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

The capability classification of map units in this park is given in the section “Detailed Soil Map Units” and in table 2.

Prime and Other Important Farmland

Table 3 lists the map units in the park that are considered important farmlands. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance. This list does not constitute a recommendation for a particular land use.

In an effort to identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State, and local government organizations, has inventoried land that can be used for the production of the Nation's food supply.

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

For some of the soils identified in the table as prime farmland, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures.

A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. The water supply is dependable and of adequate quality. Nearness to markets is an additional consideration. Unique farmland is not based on national criteria. It commonly is in areas where there is a special microclimate, such as the wine country in California.

In some areas, land that does not meet the criteria for prime or unique farmland is considered to be *farmland of statewide importance* for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed

according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law.

In some areas that are not identified as having national or statewide importance, land is considered to be *farmland of local importance* for the production of food, feed, fiber, forage, and oilseed crops. This farmland is identified by the appropriate local agencies. Farmland of local importance may include tracts of land that have been designated for agriculture by local ordinance.

Hydric Soils

Table 4 lists the map unit components that are rated as hydric soils in the park. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; USDA-NRCS, 2010).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in “Soil Taxonomy” (Soil Survey Staff, 1999) and “Keys to Soil Taxonomy” (Soil Survey Staff, 2010) and in the “Soil Survey Manual” (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in “Field Indicators of Hydric Soils in the United States” (USDA-NRCS, 2010).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2B3). Definitions for the codes are as follows:

1. All Histels except for Folistels and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2) a water table at a depth of 0.5 foot or less during the growing season if saturated hydraulic conductivity (K_{sat}) is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3) a water table at a depth of 1.0 foot or less during the growing season if saturated hydraulic conductivity (K_{sat}) is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for periods of long or very long duration during the growing season.
4. Soils that are frequently flooded for periods of long or very long duration during the growing season.

Ecological Sites

Plant communities are largely dependent on the soil, climate, topography, aspect, and slope of the landscape, as well as other abiotic features. To better understand these soil-plant interactions and the effects of selected management practices, the Natural Resources Conservation Service classifies forestlands and rangelands into ecological sites.

Landscapes of native vegetation are divided into ecological sites for the purposes of inventory, evaluation, and management. An ecological site, as defined for rangeland, is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.

An ecological site is the product of all the environmental factors responsible for its development, including parent material, landscape, climate, soils, living organisms, hydrology, fire, and time in place. Ecological site descriptions contain information on each of these environmental factors. Included are brief descriptions of: a) physiographic and climatic features; b) major identifiable plant community types that may occupy the site, including the reference plant community; c) total annual production; d) ecological dynamics of the plant communities; e) soils and their main properties; and f) site interpretations and general management considerations for wildlife, hydrology, recreation, fire, esthetics, and restoration or revegetation.

The reference plant community for a site has evolved under natural ecological processes and disturbances and is considered to be at the highest natural site potential under the current climate. It has developed on the site as a result of all site-forming factors and is best adapted to the unique combination of environmental factors associated with the site. Natural disturbances, such as fire, drought, herbivory, and flooding, were inherent in the development and maintenance of the reference plant community. Plant communities that have been subject to anthropogenic disturbances or physical site deterioration or have been protected from the natural disturbances do not typify the reference state and may exist in a stable or steady state that is different from the reference plant community.

The reference plant community of an ecological site is not a precise assemblage of species for which the proportions are the same from place to place or from year to

year. In all plant communities, the productivity and occurrence of individual species vary. Special boundaries of the communities can be recognized by characteristic patterns of species composition, association, and community structure. Generally, one species or group of species dominates the site and the stability within the natural dynamics or disturbances of the site allows the species to be used as the factor that distinguishes one site from another.

At times, the extent of the less frequently occurring plants may increase on a site or plants not formerly occurring in the reference community may invade the site. The presence or abundance of these plants may fluctuate greatly because of the ability of the plants to adapt to the differences in the microenvironment, weather conditions, soil alterations, or human actions. Using these species for site identification can be misleading; thus they should not be used to differentiate sites.

The following ecological site inventory methods are used in determining the characteristic plant communities of an ecological site:

1. Identification and evaluation of reference and/or relict sites with similar plant communities and associated soils.
2. Interpolation and extrapolation of plant, soil, and climatic data from existing historic reference areas along a continuum to other points on that continuum for which no suitable reference community is available.
3. Evaluation and comparison of the same ecological site that occurs in different areas but that has experienced different levels of disturbance and management. Further comparison is made with areas that are not disturbed.
4. Evaluation and interpretation of research data dealing with the ecology, management, and soils in areas of the plant communities.
5. Review of historical accounts, survey and military records, and botanical literature of the areas.

The initial description of the reference state should be considered an approximation subject to modification as additional knowledge is gained or discovered.

Plant communities change along environmental gradients. When changes in soils, aspect, topography, or moisture conditions are abrupt, the plant community boundaries will be reasonably distinct. Boundaries are less distinct where the plant communities change gradually over wide environmental gradients of relatively uniform soils and topography. Thus, the need for site differentiation may not be readily apparent until the cumulative impact of soil, topography, hydrology, or climate is examined over a broad area. Frequently, such differences are reflected first in production and second in the kinds and proportions of a plant species making up the core of the plant community. In some cases, the boundaries that are drawn between ecological sites along a continuum of closely related soils and a gradually changing climate are somewhat arbitrary.

The following criteria are used to differentiate one ecological site from another:

1. Significant differences in the species or species groups that are in the characteristic plant community.
2. Significant differences in the relative proportion of species or species groups in the characteristic plant community.
3. Significant differences in the total annual production or site index of the characteristic plant community.
4. Soil factors that determine plant production and composition, the hydrology of the site, and the functioning of the ecological process of the water cycle, mineral cycles, and energy flow.

Differences in kind, proportion, and production of plants are the result of differences in soil, topography, climate, and other environmental factors. Slight variations in these factors are not criteria for site differentiation. Individual environmental factors are frequently associated with significant differences in reference plant communities. For differentiation into a distinct site to occur, the differences in the environmental

factors must be great enough to affect the kinds, amounts, and proportions of the plant community.

Forestland is a spatially defined site where the reference community has at least 25 percent canopy cover. The reference community is the present-day climax community that most resembles the forest conditions prior to European contact. It developed with natural disturbances such as drought, fire, and insects. Several other plant communities may be present during the seral stages of development. Vegetation on forestland provides many habitat components, assists in controlling soil erosion, is suitable for grazing or browsing by wildlife, and offers scenic and recreational opportunities. Forestland is environmentally and economically important. For more information about NRCS national forestry policies, see the NRCS "National Forestry Manual," which is available online at http://soils.usda.gov/technical/nfmanual/.

The reference community for a rangeland ecological site does not have the potential to produce at least 25 percent canopy cover. Several other plant communities may be present during phases of development or altered conditions. Vegetation on rangeland provides many habitat components, assists in controlling soil erosion, is suitable for grazing or browsing by wildlife and domestic animals, and offers scenic and recreational opportunities. Rangeland is environmentally and economically important.

Table 5 lists the map unit symbol and each map unit component's name and percent of map unit alongside the ecological site name, ecological site type (forestland or rangeland), and ecological site number. Approved ecological site descriptions are available online at http://esis.sc.egov.usda.gov/. These descriptions are dynamic documents that are constantly updated as new research and data is gained; thus, the online version will be the most recent version of the descriptions.

Landscape, Parent Material, and Ecological Site

Table 6 displays information related to the ecological sites that are correlated to each soil in a map unit.

Percent of the map unit is the extent of the named soil in the map unit.

Slope is the inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The table shows the low and high range of slope for the named component or soil.

Elevation is the height of an object or area on the earth's surface in reference to a fixed reference point, such as mean sea level. The typical low and high range of elevation is displayed for each soil.

MAP is the mean annual precipitation for areas of the soil in the map unit.

Landscape refers to the broad shape of the earth in the area where the soil occurs. Examples are a valley and a mountain.

Landform is a specific shape of the earth in the area where a soil typically occurs. Examples are a mountain summit and a valley bottom.

Parent material is the material in which soils formed. Examples are the underlying geological material (including bedrock), a surficial deposit (such as volcanic ash), and organic material. Soils inherit their chemical and physical properties from the parent material.

Ecological site name and number is the ecological site name and unique reference number that are correlated to the named soil in the map unit.

Rangeland

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil that supports rangeland vegetation, the ecological site and the potential annual production of vegetation in favorable, normal, and unfavorable years. An explanation of the column headings in table 7 follows.

An *ecological site* is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff, that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of a site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided in the "Field Office Technical Guide," which is available in local offices of the Natural Resources Conservation Service.

Total dry-weight production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in chapter 4 of the "National Range and Pasture Handbook," which is available in local offices of the Natural Resources Conservation Service.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Land Management

In table 8, parts I through IV, interpretive ratings are given for various aspects of land management. The ratings are both verbal and numerical.

Some rating class terms indicate the degree to which the soils are suited to a specified land management practice. *Well suited* indicates that the soil has features that are favorable for the specified practice and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified practice. One or more soil properties are less than desirable, and fair performance can be expected.

Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified practice. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. *Unsuited* indicates that the expected performance of the soil is unacceptable for the specified practice or that extreme measures are needed to overcome the undesirable soil properties.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified land management practice (1.00) and the point at which the soil feature is not a limitation (0.00).

Rating class terms for *fire damage* and *seedling mortality* are expressed as low, moderate, and high. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for fire damage or seedling mortality is highest (1.00) and the point at which the potential is lowest (0.00).

Rating class terms for *hazard of erosion* are expressed as slight, moderate, severe, and very severe. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for erosion is highest (1.00) and the point at which the potential is lowest (0.00).

The paragraphs that follow indicate the soil properties considered in rating the soils for land management practices.

Ratings in the columns *suitability for hand planting* and *suitability for mechanical planting* are based on slope, depth to a restrictive layer, content of sand, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, moderately suited, poorly suited, or unsuited to these methods of planting. It is assumed that necessary site preparation is completed before seedlings are planted.

Ratings in the column *soil rutting hazard* are based on depth to a water table, rock fragments on or below the surface, the Unified classification, depth to a restrictive layer, and slope. Ruts form as a result of the operation of planting equipment. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that the soil is subject to little or no rutting, *moderate* indicates that rutting is likely, and *severe* indicates that ruts form readily.

Ratings in the column *hazard of erosion* are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in areas where 50 to 75 percent of the surface has been exposed by different kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column *hazard of erosion on roads and trails* are based on the soil erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column *suitability for roads (natural surface)* are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings

indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use.

Ratings in the column *suitability for mechanical site preparation (deep)* are based on slope, depth to a restrictive layer, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 3 feet is considered in the ratings.

Ratings in the column *suitability for mechanical site preparation (surface)* are based on slope, depth to a restrictive layer, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 1 foot is considered in the ratings.

Ratings in the column *potential for damage to soil by fire* are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a low, moderate, or high potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

Ratings in the column *potential for seedling mortality* are based on flooding, ponding, depth to a water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. The soils are described as having a low, moderate, or high potential for seedling mortality.

Recreation

The soils of the park are rated in table 9, parts I and II, according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the table are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, and water management.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Foot traffic and equestrian trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Mountain bike and off-road vehicle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, depth to a water table, ponding, slope, flooding, and texture of the surface layer.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, landscaping, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the “Soil Properties” section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section.

Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for septic tank absorption fields and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, ponds, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 10 shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the

load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Roads and Streets, Shallow Excavations, and Landscaping

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 11 shows the degree and kind of soil limitations that affect local roads and streets, shallow excavations, and landscaping.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the

amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Landscaping requires soils on which turf, trees, and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sewage Disposal

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (K_{sat}), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (K_{sat}), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Saturated hydraulic conductivity (K_{sat}) is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used

as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a K_{sat} rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Source of Gravel and Sand

Table 13 gives information about the soils as potential sources of gravel and sand. Normal compaction, minor processing, and other standard construction practices are assumed.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. Only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet.

The soils are rated *good, fair,* or *poor* as potential sources of sand and gravel. A rating of *good* or *fair* means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

Source of Reclamation Material, Roadfill, and Topsoil

Table 14 gives information about the soils as potential sources of reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated *good, fair,* or *poor* as potential sources of reclamation material, roadfill, and topsoil. The features that limit the soils as sources of these materials are specified in the table. Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability

of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments. The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Ponds and Embankments

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the saturated hydraulic conductivity (K_{sat}) of the soil and the depth to

fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, K_{sat} of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine particle-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering properties, physical and chemical properties, and pertinent soil and water features.

Engineering Properties

Table 16 gives the engineering classifications and the range of engineering properties for the layers of each soil in the park.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, “gravelly.”

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement,

the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical Soil Properties

Table 17 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the park. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (K_{sat}), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$- or $^1/_{10}$-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water

and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (K_{sat}) refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (K_{sat}). The estimates in the table indicate the rate of water movement, in inches per hour, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on the basis of measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low,* a change of less than 3 percent; *moderate,* 3 to 6 percent; *high,* 6 to 9 percent; and *very high,* greater than 9 percent.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion Properties

Table 18 shows estimates of some erosion factors that affect a soil's potential for different uses. These estimates are given for each layer of every soil for K factors and are given as one rating for the entire soil for the T factor, the wind erodibility group, and the wind erodibility index. Values are reported for each soil in the park. Estimates are based on field observations and on test data for these and similar soils.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Soil erosion factors Kw and Kf quantify soil detachment by runoff and raindrop impact. These erosion factors are indexes used to predict the long-term average soil loss from sheet and rill erosion under crop systems and conservation techniques. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and K_{sat}. Values

of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

The procedure for determining the Kf factor is outlined in Agriculture Handbook 703, "Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE)," USDA, Agricultural Research Service, 1997.

Depth to the upper and lower boundaries of each layer is indicated.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments. In horizons where total rock fragments are 15 percent or more, by volume, the Kw factor is always less than the Kf factor.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size. Soil horizons that do not have rock fragments are assigned equal Kw and Kf factors.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Total Soil Carbon

Table 19 gives estimates of total soil carbon. Soil carbon occurs as organic and inorganic carbon.

Soil organic carbon (SOC) is carbon (C) in soil that originated from a biological source, such as plants, animals, or micro-organisms. SOC is found in both organic and mineral soil layers. The term "soil organic carbon" refers only to the carbon occurring in soil organic matter (SOM). Soil organic carbon makes up about one-half the weight of soil organic matter. The rest of SOM is mostly oxygen, nitrogen, and hydrogen.

Soil inorganic carbon (SIC) is carbon found in soil carbonates, typically as calcium carbonate layers in the soil or as clay-sized fractions throughout the soil. Carbonates in soils are most common in areas where evaporation rates exceed precipitation, as is the case in most desert environments. Typically, the carbonates accumulated from carbonatic dust or from solution during periods of wetter climates. Soil inorganic carbon also occurs in soils that formed in marl in all regions of the country.

The SOC and SIC contents are reported in kilograms per square meter to a depth of 2 meters or to a representative depth of either hard bedrock or a cemented horizon. The SOC and SIC values are on a whole soil basis, corrected for rock fragments.

SOC can be an indicator of overall soil fertility and soil quality that affects ecosystem function. SOM is the main reservoir for most plant nutrients, such as phosphorus and nitrogen. Managing for SOC by managing for SOM increases the content of these elements and improves soil resiliency.

Soil organic matter binds soil particles together and thus increases soil porosity and water infiltration and allows better root penetration and waterflow into the soil. Greater inflow of water reduces the hazard of erosion and the rate of surface water runoff.

Greater SOC levels improve not only soil quality but also the quality of air and water. Soil acts as a filter and improves water quality. Fertile soils that support plant life remove CO_2 from the atmosphere and increase oxygen levels through photosynthesis. Maintaining the level of soil organic carbon reduces C release into the atmosphere and thus can lessen the effects of global warming.

SIC influences the types of plants that will grow. High SIC levels are commonly associated with a higher soil pH, which limits the types of plants that will thrive.

Like SOM, soil carbonates, the source of SIC, also bind soil particles together. They fill voids in the soil and thus can reduce soil porosity. Compacted soil carbonates may restrict root penetration and waterflow into the soil.

Chemical Soil Properties

Table 20 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the park. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity (K_{sat}) and aeration, and a general degradation of soil structure.

Water Features

Table 21 gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained

soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of

flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Soil Features

Table 22 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness of the restrictive layer, which significantly affects the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, saturated hydraulic conductivity (K_{sat}), content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Formation and Classification of the Soils

This section relates the soils in Tallgrass Prairie National Preserve to the major factors of soil formation and describes the system of soil classification.

Factors of Soil Formation

By Susan B. Southard and William Wehmueller, Natural Resources Conservation Service.

Soil covers the surface of the earth as a three-dimensional body of varying depth and is made up of different proportions of organic and mineral material, pore space with gases, and water. Soils differ in their appearance, productivity, and management requirements because of their chemical and physical properties. The characteristics and properties of soils are determined by physical and chemical processes that result from the interaction of five soil-forming factors. These factors of soil formation are interdependent, and few generalizations can be made regarding any one factor unless the effects of the other factors are known. The term “pedogenesis” is often used to connote the process of soil formation.

The interacting soil-forming factors are parent material, climate, organisms, time, and relief or topography. Parent material is the source material in which soils formed. Soils are influenced by the texture and structure of the parent material and its mineralogical and chemical composition. Climate is predominantly the temperature and kind and amount of precipitation. Organisms are the plants and other organisms living in and on the soil, including humans. Time refers to how long the soil-forming factors have been operating. Relief or topography is the shape and elevation of the landscape. It affects internal and external soil properties, such as soil drainage, aeration, susceptibility to erosion, and the soil’s exposure to the sun and wind (Jenny, 1941). The process of soil formation is a sequence of events, involving biogeochemical reactions that are energized by climate and spatially related to relief or topography (Buol and others, 2011). The physical and chemical properties of soil are altered by these reactions over time.

The influence of any one of these factors varies among all parks and within localities of a particular park. Soils may differ significantly from place to place in a park and within very short distances. In some instances parks may have vast stretches of the same type of soil because of uniform soil-forming factors.

Parent Material

The unconsolidated mass in which soils form is called parent material. Parent material is a product of weathering of underlying bedrock or weathering of material that has been transported or formed in place. Organic soils are an example of soils forming in place. Weathering refers to the chemical and physical disintegration and decomposition of parent material. Few soils weather directly from the underlying rocks. More commonly, soils form in materials that have moved in from elsewhere. Soils generally have a dominant kind of parent material but are influenced by other types of parent material. Material may have been moved only a few feet by gravity, moved to greater distances by a combination of gravity and water (colluvial parent material),

or transported long distances by wind (eolian parent material) or water (alluvial parent material). Soils are said to have “residual” parent material if they formed directly from underlying rocks. Soils formed in residuum may have the same general chemistry as the original rocks depending on the degree of weathering that has occurred.

Tallgrass Prairie National Preserve is located in the Bluestem Hill Major Land Resource Area. The Bluestem Hills are referred to as the Flint Hills in Kansas and the Osage Hills in Oklahoma. Chert, also known as flint, gives rise to the local name Flint Hills. Chert is a fine grained, silica-rich sedimentary rock that may contain fossils. The unique, stair-step landscape of the park formed through a process of differential erosion. The more resistant layers of limestone and flint form the ridgetops and benches and expose prominent rock outcrops on hillsides above stream and creek valleys. The shale layers (or mudstones) have eroded into slopes between the benches of the more weather-resistant limestone layers.

The limestone and shale layers in the park are good examples of parent material sources that are either soft and break down into smaller rocks easily or that are much harder and resist the weathering processes. The combinations of the more erosion-resistant chert and limestone and the more easily eroded shales, overlying a basement rock that is tilted toward the west, resulted in the distinct surface topography found in Tallgrass Prairie National Preserve. The bedrock beneath the park is primarily Permian in age (250 to 290 million years old). The survey area was once part of a vast inland sea. Limestone deposits accumulated in areas of deep-sea waters while shales accumulated in areas that were slightly above sea level or in near-shore marine environments (Buchanan, 1986).

Chert is more resistant to weathering than limestone, and limestone is more resistant than the shales in the park. Soils in the area become stony as limestone and shale weather away, leaving the resistant chert fragments behind. The origin of the chert is not fully understood. One hypothesis suggests that as the chemical composition of the Permian inland sea changed, sponges living in the open waters began producing spicules of silica that was extracted from the seawater (Muilenberg, 1959). The increased silica content created an environment favorable for chert formation.

The soils in Tallgrass Prairie National Preserve reflect the chemistry and physical properties of the limestone and shales from which they formed. Clime soils are an example of fine textured soils that formed predominantly in residuum from the weathering of calcareous shale. Because they weathered from calcareous shale, Clime soils are calcareous. The national modal pedon for Clime soils is located in the park. Overall, there are about 500,000 acres of Clime soils mapped in Kansas; the majority of that acreage is located in the Bluestem Hills.

Such soils as Matfield and Florence formed predominantly in residuum weathered from cherty limestone. Consequently, these soils have a high content of chert fragments that are resistant to weathering and remain in the soil. The high rock content limits agricultural uses. Sogn soils are shallow soils that formed directly on limestone on uplands. Figure 1 shows the shallow Sogn soils.

Loess (which has been blown for long distances) consists mainly of silt-sized particles and is a type of parent material. It is common in parks in the Midwest. Loess can bury soils forming on other types of parent material. Some of the soils in Tallgrass Prairie National Preserve may have formed from loess in the upper part of the profile. Irwin soils on uplands have silty surface layers over clay horizons. If Irwin soils formed only from clayey shale, their silty textures should not occur only in the surface layer. Because silty textures are only in the surface layer of Irwin soils, they are suspected to be contributed by loess.

Alluvium is parent material deposited by water. Sediments along oceans, rivers, and streams have different textures, depending on whether the water moves quickly or slowly. Fast-moving water deposits gravel, rocks, and sand. Slow-moving water and

Figure 1.—The shallow Sogn soils. These soils formed directly over limestone. Scale is in feet.

lakes leave fine textured material (clay and silt) when sediments in the water settle out. All of the soils that formed from alluvium in Tallgrass Prairie National Preserve are clayey or have a high content of silt and clay. Examples are Ivan and Kahola soils mapped along drainageways. Both soils have little horizon development but do have darkened surface horizons due to the accumulation of organic matter in the low landscape positions adjacent to Palmer and Fox Creeks. Ivan soils are calcareous and highly stratified because of frequent additions from floodwaters. Figure 2 shows the profile of an Ivan soil described in Riley County, Kansas in which stratification occurs at a depth of 1.2 meters. A buried, dark A horizon is visible at this depth. Kahola soils typically occur in positions slightly higher than those of the Ivan soils, are rarely flooded, and thus lack the stratification occurring in Ivan soils. Reading soils also formed predominantly in alluvium. They are silty and occur on stream terraces where the silt has had time to settle out of the water.

The influence of parent material on soil is commonly a major factor in the development of ecological niches. The influence of parent material on soil depth and soil chemistry dictates the types of vegetation in a specific area. Table 6 shows the relationship of soils, parent material, and landscape position to ecological sites that are assigned to soils in the park. An example of an ecological niche influenced by soil parent material is the Sodic Claypan Ecological Site assigned to Dwight soils. The physical and chemical characteristics of Dwight soils have influenced plant type and growth. The dense subsoil has a high clay content and restricts vertical root development. Cracking of the soil exposes the subsoil to drying. The high clay content, although enabling the soil to hold a lot of water, also restricts the availability of water to the plant; the soil's pore size distribution holds the water at high tension. The ability of plants to extract water from Dwight soils is further inhibited by the exchangeable sodium content of the soil. Figure 3 shows the Dwight soils described in Riley County, Kansas. Large cracks that extend to a depth of 40 centimeters are visible.

Figure 2.—Profile of an Ivan soil. Ivan soils are stratified due to additions and burials of sediment by frequent floodwaters. At a depth of 1.2 meters in this photo, a buried, dark A horizon is evident.

Climate

Differences in climate can result in differences in soils. Temperature and moisture influence soil formation and are the two most commonly measured features of climate. Weathering is most active when soils are moist and warm since these soil conditions are conducive to rapid chemical reactions. Cooler temperatures result in slower chemical reactions. While average temperatures and precipitation are important, the extremes of weather in any given locale also play a major role in soil formation.

During periods of rainfall or snowmelt, water carrying dissolved or suspended solids moves through the soil in a process called leaching. The leaching process becomes active with the onset of rainfall or snowmelt. Different temperature and moisture

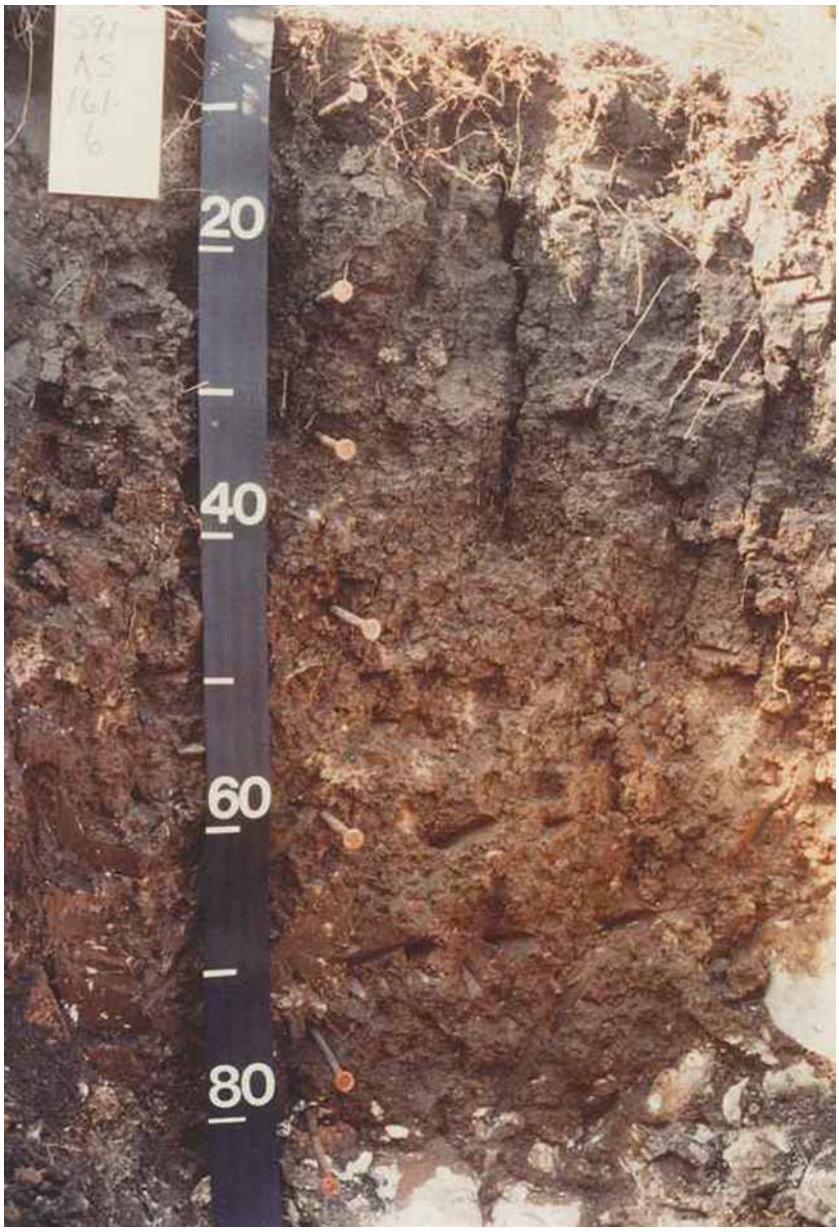

Figure 3.—Profile of a Dwight soil. Dwight soils are very clayey and have a high shrink-swell potential and exchangeable sodium content. These properties limit the availability of water to plants. Note the cracks in the photo that extend to a depth of 40 centimeters.

amounts cause different patterns of weathering and leaching in the soil. Seasonal and daily changes in temperature affect moisture effectiveness, biological activity, rates of chemical reactions, and kinds of vegetation. Tallgrass Prairie National Preserve has a local soil climate pattern of ustic (seasonally dry) and udic (usually moist) soils. Ustic soils are mapped on exposed ridgetops and side slopes while udic soils are mapped in drainages, on low terraces, and on flood plains.

Tallgrass Prairie National Preserve has a subhumid climate with an average annual precipitation of about 32 inches. A subhumid climate limits the leaching of carbonates from soils. For example, Clime soils are calcareous to the surface because of a slow rate of water intake and a slow rate of water movement through the soil.

Fluctuations in temperature and moisture affect the rate of organic matter decomposition and the leaching and accumulation of weathering products. For these reasons, cycling of bases is most pronounced in areas with a warm, humid climate and large amounts of vegetation.

Soil-forming factors are most active when the soil is warm and moist. Lack of rain, however, can also aid soil development. Most of the soils mapped in Tallgrass Prairie National Preserve have high shrink-swell clay mineralogy. The soils crack considerably during dry seasons. The soil cracks facilitate the movement of rain water down through the soil profile. Climate indirectly affects many of the soils that formed in alluvium because, in heavy rains, these soils may flood and receive new alluvial deposits of clay and silt.

Wind redistributes sand, silt, salts, carbonates, and other particles in arid, semiarid, and subhumid regions. As a result, some of the soils of the park, such as Irwin soils, have silty surface horizons derived from loess.

Freezing and thawing can affect the physical properties of clayey soils by causing aggregation. Aggregated soils are more difficult to erode by wind or water.

Some areas of the country have climates that are susceptible to wildfires. Wildfires can alter physical and chemical properties of the soil. The role of fire is prevalent in almost every ecosystem. However, few ecosystems involve fire as frequently as the prairie. Fires are started naturally, by lighting igniting flammable material, or by humans. The Plains Indians started fires to attract game to new grasses. Fire and grazing are two important factors in prairie management.

The benefits of fire are enormous. The tied-up nutrients that take months or years to decay are turned to ash within seconds and take a form usable to plants. Sunlight warms the blackened ground and stimulates dormant plants to sprout and grow. Grazers are able to feed uninhibited by dead litter.

Organisms

Plants, animals, micro-organisms, and humans affect the formation of soils. Flora, such as fungi and bacteria, help to decompose organic matter and add nutrients to the soil. Animals and micro-organisms mix soils and form burrows and pores. Earthworm activity is usually evident in Reading, Ivan, and Chase soils. Plant roots open channels in the soils. Abandoned tunnels commonly are filled with loose material from the overlying horizons and transmit water more readily than the surrounding undisturbed soil material.

Different types of roots have different effects on soils. Grass roots are fibrous near the surface and easily decompose, adding organic matter to the soil. Fine grass roots can extend below the surface for many feet. Plant roots also help to develop soil structure and aggregate stability. Vegetation increases soil stability by protecting the surface against erosion. Taproots open pathways through dense layers. Micro-organisms affect chemical exchanges between roots and soil. Animals also can mix the soil extensively. Grazing animals play an important role in maintaining the ecosystem by stimulating plants to grow. This triggers biological activity and nutrient exchanges. Bison, deer, and cattle compact the soil with their hooves and expose new areas where seeds can grow and plants can take root.

The native vegetation depends on climate, topography, and biological factors plus many soil factors, such as soil density, depth, chemistry, temperature, and moisture. Tallgrass prairie stems and roots decompose on and in the soil. Organisms decompose the organic matter and mix it with the upper part of the soil, resulting in the cycling of nutrients and energy back to vegetation. The accumulation of organic matter in the soil is evident in all the soils of Tallgrass Prairie National Preserve because all the soils are Mollisols. Mollisols are mineral soils that have very dark surface horizons with high contents of organic matter. They commonly form under grass vegetation where there is enough available moisture to support perennial grasses. The organic

matter in these soils gives the soil a granular structure that aids water penetration and thus allows seeds to germinate.

Time

Time for parent material, climate, organisms, and topography to interact is also a soil-forming factor. Soil formation processes are continuous. Over time, soils exhibit features that reflect the other soil-forming factors. Recently deposited material, such as material deposited by a flood along Fox Creek, exhibits no features from soil development activities. Ivan soils on flood plains have few distinctive characteristics and no diagnostic subsurface horizons and are the youngest, least developed soils of the park. As a result of flooding, the previous soil surface and underlying horizons become buried. The time clock resets for these soils. The different horizons in a soil profile and the degree of development can be directly related to time.

The terraces of Fox Creek in Tallgrass Prairie National Preserve are above the active flood plain and are more stable land surfaces. Thus, the soils on these terraces exhibit more horizon development. Upland soils, such as Matfield and Florence, formed on cherty limestone and have well developed argillic diagnostic subsurface horizons. These soils have had enough time to develop distinctive profile characteristics. Matfield and Florence soils are the most developed soils in the park.

Topography and Relief

Topography refers to the shape of the landscape, and relief refers to differences in elevation. The overall landscape, whether it consists of flat plains, rolling hills, or steep escarpments, is the result of erosion and constructional processes. These processes may have occurred in response to changes in climate, fluctuating sea levels, and/or tectonic activities. Cyclic periods of landscape stability and instability influence the types of soils that form on the landscape.

Slope and aspect of the overall landscape can affect the moisture and temperature of the soil. Relief influences soil formation through its controlling effect on drainage, runoff, and other effects from water, including normal and accelerated erosion. The amount of water that moves through the soil depends on topography. As a general rule, less water enters the soil on steep slopes than on flatter slopes.

Steep slopes facing the sun are warmer. They may be eroded and lose their surface horizons as soon as they form. Thus, these soils may be thinner than the more nearly level ones that receive deposits from areas upslope. Deeper, darker soils occur on the bottom land. Soil-forming factors continue to affect soils even on stable landscapes. Materials are deposited on the surface, and materials are blown or washed away from the surface. Additions, removals, and alterations are slow or rapid, depending on climate, landscape position, and biological activity. Matfield and Florence soils are on a stable part of the landscape where the rate of runoff is lower. As a result, the weathering intensity for these soils is greater because there are greater amounts of soil moisture with increasing depth. Matfield soils (on ridgetops) are weathered more than Florence soils (on side slopes) because they are on more level slopes.

The youngest geomorphic surfaces in the park generally are toeslopes, flood plains, and drainageways associated with Fox Creek and its tributaries where alluvium has been deposited. Soils such as Ivan formed on these young geomorphic surfaces.

Clime soils occur on steep slopes where the soft shale parent material has been actively eroding. As a result of landscape position and the surrounding relief, Clime soils are calcareous throughout. In other areas of the park where there is the same parent material but more stable topography, soils such as Martin form. The carbonates have been partially leached from these soils. The landscape position affords a greater leaching potential.

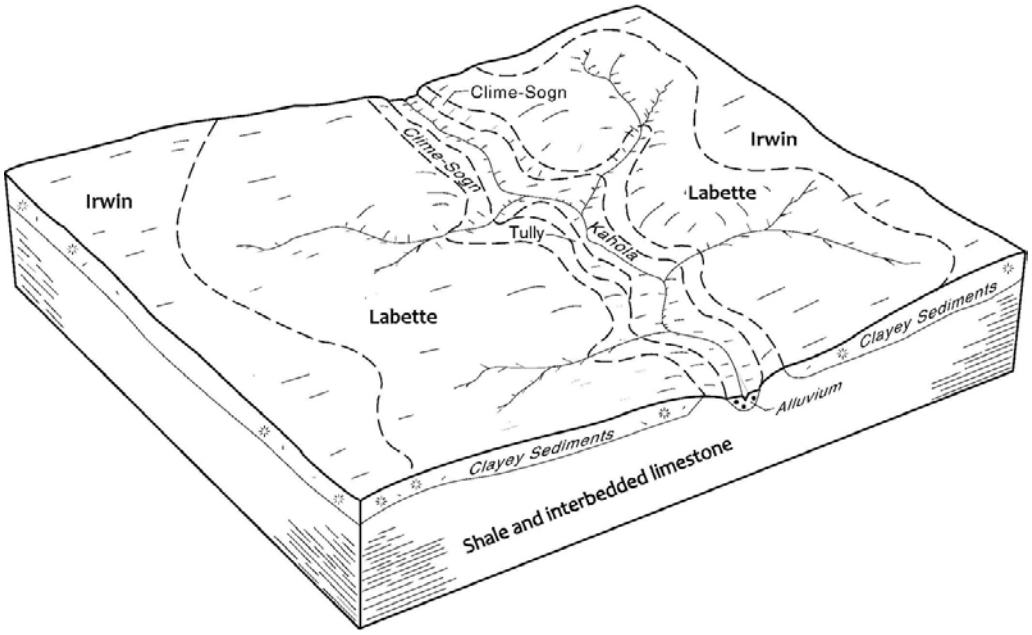

Figure 4.—A stylized view of the relationships of some soils to landscape position in Tallgrass Prairie National Preserve. The landscape relief in the park is greater than depicted in this diagram. Ivan and Kohala soils are along drainageways; Tully, Clime, and Sogn soils are on hillslopes associated with the drainageways; and Irwin and Labette soils are mostly on uplands between drainageways.

For thousands of years, the climate and drainage patterns of the Flint Hills have defined the prairie ecosystem. Figure 4 is a stylized illustration of a typical drainage pattern and its associated soils found in Tallgrass Prairie National Preserve.

Classification of the Soils

Soils are named and classified on the basis of physical and chemical properties in their horizons (layers). Color, texture, structure, and other properties of the soil to a depth of 2 meters are used to key the soil into a classification system. This system helps people to use soil information and also provides a common language for scientists.

Soils and their horizons differ from one another, depending on how and when they formed. Soil scientists use the five soil-forming factors to help predict where different soils may occur. The degree and expression of the soil horizons reflect the extent of interaction of the soil-forming factors with one or more of the soil-forming processes (Simonson, 1959).

When mapping soils, a soil scientist looks for areas with similar soil-forming factors to find similar soils. The properties of the soils are described. Soils with the same kind of properties are given taxonomic names. Soils are classified, mapped, and interpreted on the basis of various kinds of soil horizons and their arrangement. The distribution of soil orders corresponds with the general patterns of the soil-forming factors within the park.

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2010). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The categories are defined in the following paragraphs.

ORDER. Soil taxonomy at the highest hierarchical level identifies 12 soil orders. The names for the orders and taxonomic soil properties relate to Greek, Latin, or other root words that reveal something about the soil. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. Sixty-four suborders are recognized at the next level of classification. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning ustic moisture regime, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. There are about 300 great groups. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Natrustolls (*Natr*, meaning sodium affected and having a natric horizon, plus *Ustolls*, the suborder of the Mollisols that has a ustic moisture regime).

SUBGROUP. There are more than 2,400 subgroups. Each great group has a typic subgroup. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Other subgroups are intergrades or extragrades. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Natrustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties for family placement are those of horizons below a traditional agronomic plow depth. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, smectic, mesic Typic Natrustolls.

SERIES. The soil series is the lowest category in the soil classification system. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Most parks are mapped to the series level. The names of soil series are selected by the soil scientists during the course of mapping. The series names are commonly geographic place names or are coined. Because of access limitations and soil variability, soils in some remote areas are classified at the great group or subgroup level.

Table 23 indicates the order, suborder, great group, subgroup, and family of the soil series in the park.

Soil Series and Their Morphology

In this section, the Clime soil series is described. Characteristics of the soil and the material in which it formed are identified. A pedon, a small three-dimensional area of soil, which is typical of the series in the survey area, is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” (Soil Survey Division Staff, 1993). Many of the technical terms used in the description are defined in “Soil Taxonomy” (Soil Survey Staff, 1999) and in “Keys to Soil Taxonomy” (Soil Survey Staff, 2010). Following the pedon description is the range of important

characteristics of the soils in the series. The map unit in the survey area with Clime soil as a major component (map unit 1382816) is described in the section “Detailed Soil Map Units.”

Clime Series

The Clime series consists of moderately deep, well drained, slowly permeable soils on uplands that have a plane or convex surface. They formed in residuum from calcareous clayey shale. Slopes range from 1 to 60 percent. Mean annual temperature ranges from 54 to 57 degrees F, and mean annual precipitation ranges from 29 to 35 inches. Thornthwaites Annual PE Index ranges from 48 to 60.

Geographically Associated Soils

- Benfield soils, which have an argillic horizon and a soil mass that is not calcareous within a depth of 28 inches; in positions similar to those of the Clime soils
- Irwin and Labette soils, which have an argillic horizon; on divides above the Clime soils
- Kipson soils, which are shallow over shale; in similar positions
- Martin and Tully soils, which have an argillic horizon; on footslopes
- Sogn soils, which are shallow over limestone; generally in the less sloping areas

Taxonomic Classification

Fine, mixed, active, mesic Udorthentic Haplustolls

Typical Pedon

Clime silty clay; in Tallgrass Prairie National Preserve (in Chase County, Kansas); about 4 miles north and 0.5 mile west of Cottonwood Falls, 820 feet west and 1,800 feet south of the northeast corner, section 31, T. 18 S., R. 8 E., on a 5 percent northeast-facing slope, in rangeland. (Colors are for dry soil unless otherwise stated.)

A—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, very dark brown (10YR 2/2) moist; moderate fine granular structure; hard, firm; many roots; slight effervescence; moderately alkaline; clear smooth boundary. (5 to 12 inches thick)

Bw—9 to 18 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, very firm; few roots; strong effervescence; moderately alkaline; clear smooth boundary. (6 to 20 inches thick)

C—18 to 33 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm; horizon contains many shale fragments; strong effervescence; moderately alkaline; diffuse smooth boundary. (0 to 20 inches thick)

Cr—33 to 60 inches; light gray (10YR 7/2) consolidated calcareous clay shales.

Range in Characteristics

Thickness of mollic epipedon: 7 to 20 inches
Depth to shale: 20 to 40 inches
Depth to free carbonates: 0 to 10 inches
Reaction: Dominantly lightly alkaline or moderately alkaline throughout the profile; a few pedons are neutral to a depth of 10 inches

A horizon:
Hue—10YR or 2.5Y
Value—3 to 5 dry; 2 or 3 moist
Chroma—1 or 2
Texture—silty clay or silty clay loam; range includes stony and very stony surface phases

Rock fragments—0.01 to 3 percent, by volume, limestone fragments on the surface that are 3 inches to 2 feet in diameter

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 7 dry; 3 to 6 moist
Chroma—1 to 4
Texture—silty clay, clay, or silty clay loam
Rock fragments—0 to 10 percent shale fragments that are less than 3 inches in diameter

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 7 dry; 4 to 6 moist
Chroma—2 to 4
Texture—silty clay, clay, or silty clay loam
Rock fragments—less than 35 percent, by volume, shale fragments

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface. Runoff, or surface flow of water, from an area.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building

up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water. Water filling all the unblocked pores of the material below the water table.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

K_{sat}. Saturated hydraulic conductivity. (See Permeability.)

Leaching. The removal of soluble material from soil or other material by percolating water.

LEP. See Linear extensibility percent.

Linear extensibility (LE). Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Linear extensibility percent. Refers to the percent change in linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.
Low strength. The soil is not strong enough to support loads.
Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.
Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.
Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.
Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.
Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.
Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)
Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.
Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.
Parent material. The unconsolidated organic and mineral material in which soil forms.
Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.
Pedon. The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.
Percolation. The movement of water through the soil.
Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as “saturated hydraulic conductivity,” which is defined in the “Soil Survey Manual.” In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as “permeability.” Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.
pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)
Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.
Plowpan. A compacted layer formed in the soil directly below the plowed layer.
Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.
Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.
Potential native plant community. See Climax plant community.
Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.
Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.
Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.
Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.
Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.
Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.
Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.
Relief. The elevations or inequalities of a land surface, considered collectively.
Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.
Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.
Root zone. The part of the soil that can be penetrated by plant roots.
Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Series, soil. A group of soils that have profiles that are almost alike. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Soil strength. The load-supporting capacity of a soil at specific moisture and density conditions.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

Table 1.—Soil Legend

Map unit symbol and map unit name	Components in map unit	Percent of map unit
1382809:		
Smolan silty clay loam, 3 to 7 percent slopes	Smolan	90
	Irwin	5
	Tully	5
1382810:		
Chase silty clay loam, occasionally flooded	Chase	90
	Osage	5
	Reading	5
	Aquolls, ponded	<1
1382811:		
Ivan silt loam, channeled	Ivan	80
	Reading	20
	Aquolls	<1
	Aquolls, ponded	<1
1382812:		
Ivan silt loam, occasionally flooded	Ivan	85
	Kahola	8
	Reading	7
	Osage, hydric	<1
1382813:		
Kahola silt loam, rarely flooded	Kahola	85
	Ivan	8
	Reading	7
	Osage, hydric	<1
1382816:		
Clime-Sogn complex, 3 to 20 percent slopes	Clime	67
	Sogn	30
	Rock outcrop	3
	Aquolls	<1
1382818:		
Dwight silt loam, 1 to 3 percent slopes	Dwight	85
	Labette	8
	Irwin	7
1382821:		
Florence-Labette complex, 2 to 12 percent slopes	Florence	47
	Labette	34
	Unknown soils	19

Table 1.—Soil Legend—Continued

Map unit symbol and map unit name	Components in map unit	Percent of map unit
1382822:		
Florence-Matfield cherty silt loams, 1 to 15 percent slopes	Florence	70
	Matfield	25
	Labette	3
	Dwight	2
1382823:		
Irwin silty clay loam, 1 to 3 percent slopes	Irwin	85
	Dwight	5
	Labette	5
	Ladysmith	5
	Aquolls	<1
1382824:		
Irwin silty clay loam, 1 to 3 percent slopes, eroded	Irwin, eroded	95
	Dwight	5
	Aquolls	<1
1382825:		
Irwin silty clay loam, 3 to 7 percent slopes	Irwin	90
	Tully	10
	Aquolls	<1
1382826:		
Irwin silty clay loam, 3 to 7 percent slopes, eroded	Irwin, eroded	90
	Tully	10
	Aquolls	<1
1382827:		
Labette silty clay loam, 1 to 3 percent slopes	Labette	85
	Dwight	5
	Irwin	5
	Ladysmith	5
1382828:		
Labette silty clay loam, 3 to 7 percent slopes	Labette	85
	Irwin	8
	Dwight	7

Table 1.—Soil Legend—Continued

Map unit symbol and map unit name	Components in map unit	Percent of map unit
1382830:		
Labette-Dwight complex, 0 to 3 percent slopes	Labette	50
	Dwight	41
	Irwin	3
	Ladysmith	3
	Zaar	3
1382831:		
Labette-Sogn silty clay loams, 0 to 8 percent slopes	Labette	47
	Sogn	38
	Florence	8
	Dwight	7
	Aquolls	<1
1382833:		
Tully cherty silty clay loam, 5 to 15 percent slopes	Tully	70
	Clime	15
	Martin	15
1382834:		
Tully silty clay loam, 3 to 7 percent slopes	Tully	85
	Irwin	5
	Martin	5
	Smolan	3
	Dwight	2
1382835:		
Tully silty clay loam, 3 to 7 percent slopes, eroded	Tully, eroded	85
	Irwin	5
	Martin	5
	Smolan	3
	Dwight	2
1382836:		
Reading silt loam, rarely flooded	Reading	85
	Kahola	8
	Chase	7
	Osage, hydric	<1

Table 1.—Soil Legend—Continued

Map unit symbol and map unit name	Components in map unit	Percent of map unit
1382837:		
Reading silt loam, 1 to 3 percent slopes	Reading	90
	Tully	10
	Osage, hydric	<1
1382839:		
Martin silty clay loam, 3 to 7 percent slopes	Martin	85
	Clime	5
	Tully	5
	Zaar	5
1382840:		
Martin silty clay loam, 3 to 7 percent slopes, eroded	Martin, eroded	85
	Clime	5
	Tully	5
	Zaar	5
1382841:		
Martin-Gullied land complex, 3 to 10 percent slopes	Martin, eroded	80
	Gullied land	20
	Clime	<1
	Zaar	<1
1382845:		
Zaar silty clay, 3 to 7 percent slopes	Zaar	85
	Clime	5
	Dwight	5
	Martin	5
1382846:		
Zaar-Dwight complex, 1 to 3 percent slopes	Zaar	55
	Dwight	45
	Clime	<1
	Ladysmith	<1
	Martin	<1
1382849:		
Borrow pits	Borrow pits	100
1382850:		
Gravel pits and quarries	Gravel pits and quarries	100

Table 1.—Soil Legend—Continued

Map unit symbol and map unit name	Components in map unit	Percent of map unit
1382851:		
Miscellaneous water	Miscellaneous water	100
1382852:		
Water	Water	100

Table 2.—Land Capability Classification

(Land capability classification is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time. Only the soils suitable for cultivation are listed)

Map unit symbol and component name	Land capability	
	N	I
1382809:		
Smolan	3e	---
1382810:		
Chase	2w	---
1382811:		
Ivan	5w	---
1382812:		
Ivan	2w	---
1382813:		
Kahola	2w	---
1382816:		
Clime	6e	---
Sogn	7s	---
1382818:		
Dwight	4e	---
1382821:		
Florence	6e	---
Labette	4e	---
1382822:		
Florence	6e	---
Matfield	6e	---
1382823:		
Irwin	3e	---
1382824:		
Irwin, eroded	4e	---
1382825:		
Irwin	4e	---
1382826:		
Irwin, eroded	4e	---
1382827:		
Labette	2e	---
1382828:		
Labette	3e	---
1382830:		
Labette	3e	---
Dwight	4s	---

Table 2.—Land Capability Classification—Continued

Map unit symbol and component name	Land capability	
	N	I
1382831:		
Labette	6e	---
Sogn	7e	---
1382833:		
Tully	4e	---
1382834:		
Tully	3e	---
1382835		
Tully, eroded	4e	---
1382836:		
Reading	1	---
1382837:		
Reading	2e	---
1382839:		
Martin	3e	---
1382840:		
Martin, eroded	4e	---
1382841:		
Martin, eroded	6e	---
1382845:		
Zaar	4e	---
1382846:		
Zaar	4e	---
Dwight	4s	---

Table 3.—Prime and Other Important Farmland

(Only the soils considered prime or important farmland are listed. Urban or built-up areas of the soils listed are not considered prime or important farmland)

Map unit symbol	Map unit name	Farmland classification
1382809	Smolan silty clay loam, 3 to 7 percent slopes	All areas are prime farmland
1382810	Chase silty clay loam, occasionally flooded	All areas are prime farmland
1382811	Ivan silt loam, channeled	Farmland of statewide importance
1382812	Ivan silt loam, occasionally flooded	All areas are prime farmland
1382813	Kahola silt loam, rarely flooded	All areas are prime farmland
1382816	Clime-Sogn complex, 3 to 20 percent slopes	Farmland of statewide importance
1382818	Dwight silt loam, 1 to 3 percent slopes	Farmland of statewide importance
1382821	Florence-Labette complex, 2 to 12 percent slopes	Farmland of statewide importance
1382822	Florence-Matfield cherty silt loams, 1 to 15 percent slopes	Farmland of statewide importance
1382823	Irwin silty clay loam, 1 to 3 percent slopes	All areas are prime farmland
1382824	Irwin silty clay loam, 1 to 3 percent slopes, eroded	All areas are prime farmland
1382825	Irwin silty clay loam, 3 to 7 percent slopes	All areas are prime farmland
1382826	Irwin silty clay loam, 3 to 7 percent slopes, eroded	Farmland of statewide importance
1382827	Labette silty clay loam, 1 to 3 percent slopes	All areas are prime farmland
1382828	Labette silty clay loam, 3 to 7 percent slopes	All areas are prime farmland
1382830	Labette-Dwight complex, 0 to 3 percent slopes	Farmland of statewide importance
1382831	Labette-Sogn silty clay loams, 0 to 8 percent slopes	Farmland of statewide importance
1382833	Tully cherty silty clay loam, 5 to 15 percent slopes	Farmland of statewide importance
1382834	Tully silty clay loam, 3 to 7 percent slopes	All areas are prime farmland
1382835	Tully silty clay loam, 3 to 7 percent slopes, eroded	Farmland of statewide importance
1382836	Reading silt loam, rarely flooded	All areas are prime farmland
1382837	Reading silt loam, 1 to 3 percent slopes	All areas are prime farmland
1382839	Martin silty clay loam, 3 to 7 percent slopes	All areas are prime farmland
1382840	Martin silty clay loam, 3 to 7 percent slopes, eroded	Farmland of statewide importance
1382845	Zaar silty clay, 3 to 7 percent slopes	All areas are prime farmland
1382846	Zaar-Dwight complex, 1 to 3 percent slopes	Farmland of statewide importance

Table 4.—Hydric Soils

(This report lists only those map unit components that are rated as hydric. Definitions of hydric criteria codes are included at the end of the report)

Map unit symbol and map unit name	Component	Percent of map unit	Landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
1382810:							
Chase silty clay loam, occasionally flooded	Osage	5	flood plains	2B3	Yes	No	No
	Aquolls, ponded	0	depressions	3	No	No	Yes
1382811:							
Ivan silt loam, channeled	Aquolls, ponded	0	depressions	3	No	No	Yes
	Aquolls	0	hillslopes, drainageways, depressions	2B3	Yes	No	No
1382812:							
Ivan silt loam, occasionally flooded	Osage, hydric	0	flood plains	2B3	Yes	No	No
1382813:							
Kahola silt loam, rarely flooded	Osage, hydric	---	flood plains	2B3	Yes	No	No
1382816:							
Clime-Sogn complex, 3 to 20 percent slopes	Aquolls	0	drainageways, depressions	2B3	Yes	No	No
1382823:							
Irwin silty clay loam, 1 to 3 percent slopes	Aquolls	0	drainageways, depressions	2B3	Yes	No	No
1382824:							
Irwin silty clay loam, 1 to 3 percent slopes, eroded	Aquolls	0	drainageways, depressions	2B3	Yes	No	No
1382825:							
Irwin silty clay loam, 3 to 7 percent slopes	Aquolls	0	drainageways, depressions	2B3	Yes	No	No
1382826:							
Irwin silty clay loam, 3 to 7 percent slopes, eroded	Aquolls	0	drainageways, depressions	2B3	Yes	No	No
1382831:							
Labette-Sogn silty clay loams, 0 to 8 percent slopes	Aquolls	0	drainageways, depressions	2B3	Yes	No	No
1382836:							
Reading silt loam, rarely flooded	Osage, hydric	---	flood plains	2B3	Yes	No	No

Table 4.—Hydric Soils—Continued

Map unit symbol and map unit name	Component	Percent of map unit	Landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
1382837: Reading silt loam, 1 to 3 percent slopes	Osage, hydric	---	flood plains	2B3	Yes	No	No

Explanation of hydric criteria codes:

1. All Histels (except for Folistels), and Histosols (except for Folists), which are, by definition, saturated.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      1.) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      2.) a water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      3.) a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for periods of long or very long duration during the growing season.
4. Soils that are frequently flooded for periods of long or very long duration during the growing season.

Table 5.—Ecological Sites

(Only soils and miscellaneous areas with correlated ecological sites are shown)

Map unit symbol, soil name, and percent of map unit	Ecological site name	Ecological site type	Ecological site ID
1382809:			
Smolan (90%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382810:			
Chase (90%)	Loamy Lowland (Draft) (PE 30-36)	Rangeland	R076XY013KS
1382811:			
Ivan (80%)	Loamy Lowland (Draft) (PE 30-36)	Rangeland	R076XY013KS
1382812:			
Ivan (85%)	Loamy Lowland (Draft) (PE 30-36)	Rangeland	R076XY013KS
1382813:			
Kahola (85%)	Loamy Lowland (Draft) (PE 30-36)	Rangeland	R076XY013KS
1382816:			
Clime (67%)	Limy Upland (Draft) (PE 30-36)	Rangeland	R076XY012KS
Sogn (30%)	Shallow Limy (Draft) (PE 30-36)	Rangeland	R076XY028KS
1382818:			
Dwight (85%)	Sodic Claypan (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY005KS
1382821:			
Florence (47%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
Labette (34%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382822:			
Florence (70%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
Matfield (25%)	Flint Ridge (Draft) (PE 30-36)	Rangeland	R076XY009KS
1382823:			
Irwin (85%)	Clay Upland (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY007KS
1382824:			
Irwin, eroded (95%)	Clay Upland (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY007KS
1382825:			
Irwin (90%)	Clay Upland (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY007KS
1382826:			
Irwin, eroded (90%)	Clay Upland (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY007KS

Table 5.—Ecological Sites—Continued

Map unit symbol, soil name, and percent of map unit	Ecological site name	Ecological site type	Ecological site ID
1382827:			
Labette (85%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382828:			
Labette (85%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382830:			
Labette (50%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
Dwight (41%)	Sodic Claypan (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY005KS
1382831:			
Labette (47%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
Sogn (38%)	Shallow Limy (Draft) (PE 30-36)	Rangeland	R076XY028KS
1382833:			
Tully (70%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382834:			
Tully (85%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382835:			
Tully, eroded (85%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382836:			
Reading (85%)	Loamy Lowland (Draft) (PE 30-36)	Rangeland	R076XY013KS
1382837:			
Reading (90%)	Loamy Lowland (Draft) (PE 30-36)	Rangeland	R076XY013KS
1382839:			
Martin (85%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382840:			
Martin, eroded (85%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382841:			
Martin, eroded (80%)	Loamy Upland (Draft) (PE 30-36)	Rangeland	R076XY015KS
1382845:			
Zaar (85%)	Clay Upland (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY007KS
1382846:			
Zaar (55%)	Clay Upland (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY007KS
Dwight (45%)	Sodic Claypan (Draft) (Peer Review) (PE 30-36)	Rangeland	R076XY005KS

Table 6.—Landscape, Parent Material, and Ecological Site

(Miscellaneous nonsoil components are not displayed in this report. Component percents may not add up to 100. MAP is the mean annual precipitation)

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Ft	In				
1382809:								
Smolan	90	2-6	None assigned	31-47	Upland	Paleoterrace	Silty and clayey loess	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382810:								
Chase	90	0-2	1001-1401	31-47	River valley	Flood plain	Silty and clayey alluvium	Loamy Lowland (Draft) (PE 30-36), R076XY013KS
1382811:								
Ivan	80	0-3	98-1201	31-47	River valley	Flood plain	Calcareous fine-silty alluvium	Loamy Lowland (Draft) (PE 30-36), R076XY013KS
1382812:								
Ivan	85	0-2	98-1201	31-47	River valley	Flood plain	Calcareous fine-silty alluvium	Loamy Lowland (Draft) (PE 30-36), R076XY013KS
1382813:								
Kahola	85	0-2	1001-1201	31-47	River valley	Flood plain	Fine-silty alluvium	Loamy Lowland (Draft) (PE 30-36), R076XY013KS
1382816:								
Clime	67	3-15	1001-1699	31-47	Upland	Hillslope	Silty and clayey residuum weathered from calcareous shale	Limy Upland (Draft) (PE 30-36), R076XY012KS
Sogn	30	3-15	801-2001	31-47	Upland	Hillslope	Loamy residuum weathered from limestone	Shallow Limy (Draft) (PE 30-36), R076XY028KS
1382818:								
Dwight	85	1-3	801-2598	31-47	Upland	Hillslope	Silty and clayey residuum weathered from cherty limestone	Sodic Claypan (Draft) (Peer Review) (PE 30-36), R076XY005KS
1382821:								
Florence	47	2-12	1001-1499	31-47	Upland	Hillslope	Clayey residuum weathered from clayey shale and/or clayey residuum weathered from cherty limestone	Loamy Upland (Draft) (PE 30-36), R076XY015KS

Table 6.—Landscape, Parent Material, and Ecological Site—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Ft	In				
1382821:								
Labette	34	2-8	1001-1401	31-47	Upland	Hillslope	Silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382822:								
Florence	70	2-15	1001-1499	31-47	Upland	Hillslope	Clayey residuum weathered from clayey shale and/or clayey residuum weathered from cherty limestone	Loamy Upland (Draft) (PE 30-36), R076XY015KS
Matfield	25	1-5	1001-1401	31-47	Upland	Hillslope	Clayey residuum weathered from cherty limestone	Flint Ridge (Draft) (PE 30-36), R076XY009KS
1382823:								
Irwin	85	1-3	1001-1601	31-47	Upland	Hillslope	Silty and clayey residuum weathered from clayey shale	Clay Upland (Draft) (Peer Review) (PE 30-36), R076XY007KS
1382824:								
Irwin, eroded	95	1-3	1001-1601	31-47	Upland	Hillslope	Silty and clayey residuum weathered from clayey shale	Clay Upland (Draft) (Peer Review) (PE 30-36), R076XY007KS
1382825:								
Irwin	90	3-5	1001-1601	31-47	Upland	Hillslope	Silty and clayey residuum weathered from clayey shale	Clay Upland (Draft) (Peer Review) (PE 30-36), R076XY007KS
1382826:								
Irwin, eroded	90	3-5	1001-1601	31-47	Upland	Hillslope	Silty and clayey residuum weathered from clayey shale	Clay Upland (Draft) (Peer Review) (PE 30-36), R076XY007KS
1382827:								
Labette	85	1-3	1001-1401	31-47	Upland	Hillslope	Silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS

Table 6.—Landscape, Parent Material, and Ecological Site—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Ft	In				
1382828:								
Labette	85	3-5	1001-1401	31-47	Upland	Hillslope	Silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382830:								
Labette	50	1-3	1001-1401	31-47	Upland	Hillslope	Silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS
Dwight	41	1-3	801-2598	31-47	Upland	Hillslope	Silty and clayey residuum weathered from cherty limestone	Sodic Claypan (Draft) (Peer Review) (PE 30-36), R076XY005KS
1382831:								
Labette	47	2-8	1001-1401	31-47	Upland	Hillslope	Silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS
Sogn	38	2-12	801-2001	31-47	Upland	Hillslope	Loamy residuum weathered from limestone	Shallow Limy (Draft) (PE 30-36), R076XY028KS
1382833:								
Tully	70	5-15	1001-1601	31-47	Upland	Hillslope	Clayey colluvium	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382834:								
Tully	85	3-7	1001-1601	31-47	Upland	Hillslope	Clayey colluvium	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382835:								
Tully, eroded	85	3-7	1001-1601	31-47	Upland	Hillslope	Clayey colluvium	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382836:								
Reading	85	0-1	1001-1201	31-47	River valley	Terrace	Silty alluvium	Loamy Lowland (Draft) (PE 30-36), R076XY013KS
1382837:								
Reading	90	1-3	1001-1201	31-47	River valley	Terrace	Silty alluvium	Loamy Lowland (Draft) (PE 30-36), R076XY013KS

Table 6.—Landscape, Parent Material, and Ecological Site—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	Ecological site name and number
	Pct	Pct	Ft	In				
1382839:								
Martin	85	2-6	801-1601	31-47	Upland	Hillslope	Silty and clayey colluvium derived from limestone and shale over silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382840:								
Martin, eroded	85	2-6	801-1601	31-47	Upland	Hillslope	Silty and clayey colluvium derived from limestone and shale over silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382841:								
Martin, eroded	80	3-10	801-1601	31-47	Upland	Hillslope	Silty and clayey colluvium derived from limestone and shale over silty and clayey residuum weathered from limestone and shale	Loamy Upland (Draft) (PE 30-36), R076XY015KS
1382845:								
Zaar	85	3-7	None assigned	31-47	Upland	Hillslope	Ancient alluvium and/or clayey colluvium and/or residuum weathered from shale	Clay Upland (Draft) (Peer Review) (PE 30-36), R076XY007KS
1382846:								
Zaar	55	1-3	None assigned	31-47	Upland	Hillslope	Ancient alluvium and/or clayey colluvium and/or residuum weathered from shale	Clay Upland (Draft) (Peer Review) (PE 30-36), R076XY007KS
Dwight	45	1-3	801-2598	31-47	Upland	Hillslope	Silty and clayey residuum weathered from cherty limestone	Sodic Claypan (Draft) (Peer Review) (PE 30-36), R076XY005KS

Table 7.—Rangeland Productivity

(Only the soils that support rangeland vegetation suitable for grazing are rated)

Map unit symbol and soil name	Ecological site and symbol	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
1382809:				
Smolan	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,000	3,000
1382810:				
Chase	Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)	10,000	8,500	6,000
1382811:				
Ivan	Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)	9,000	7,000	5,500
1382812:				
Ivan	Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)	9,000	7,000	5,500
1382813:				
Kahola	Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)	9,000	7,000	5,500
1382816:				
Clime	Limy Upland (Draft) (PE 30-36) (R076XY012KS)	5,000	3,500	2,500
Sogn	Shallow Limy (Draft) (PE 30-36) (R076XY028KS)	3,500	2,500	1,500
1382818:				
Dwight	Sodic Claypan (Draft) (Peer Review) (PE 30-36) (R076XY005KS)	4,000	3,000	2,000
1382821:				
Florence	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,500	3,500
Labette	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,500	3,500
1382822:				
Florence	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,500	3,500
Matfield	Flint Ridge (Draft) (PE 30-36) (R076XY009KS)	3,000	2,000	1,000
1382823:				
Irwin	Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)	5,000	3,500	2,000
1382824:				
Irwin, eroded	Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)	5,000	3,500	2,000

Table 7.—Rangeland Productivity—Continued

Map unit symbol and soil name	Ecological site and symbol	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
1382825:				
Irwin	Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)	5,000	3,500	2,000
1382826:				
Irwin, eroded	Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)	5,000	3,500	2,000
1382827:				
Labette	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,500	3,500
1382828:				
Labette	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,500	3,500
1382830:				
Labette	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,500	3,500
Dwight	Sodic Claypan (Draft) (Peer Review) (PE 30-36) (R076XY005KS)	4,000	3,000	2,000
1382831:				
Labette	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	5,500	4,500	3,500
Sogn	Shallow Limy (Draft) (PE 30-36) (R076XY028KS)	3,500	2,500	1,500
1382833:				
Tully	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	6,000	5,000	3,500
1382834:				
Tully	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	6,000	5,000	3,500
1382835:				
Tully, eroded	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	6,000	5,000	3,500
1382836:				
Reading	Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)	10,000	8,000	6,000
1382837:				
Reading	Loamy Lowland (Draft) (PE 30-36) (R076XY013KS)	10,000	8,000	6,000
1382839:				
Martin	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	6,500	5,000	3,500

Table 7.—Rangeland Productivity—Continued

Map unit symbol and soil name	Ecological site and symbol	Total dry-weight production		
		Favorable year	Normal year	Unfavorable year
		Lb/acre	Lb/acre	Lb/acre
1382840:				
Martin, eroded	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	6,500	5,000	3,500
1382841:				
Martin, eroded	Loamy Upland (Draft) (PE 30-36) (R076XY015KS)	6,500	5,000	3,500
1382845:				
Zaar	Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)	6,000	4,500	2,500
1382846:				
Zaar	Clay Upland (Draft) (Peer Review) (PE 30-36) (R076XY007KS)	6,000	4,500	2,500
Dwight	Sodic Claypan (Draft) (Peer Review) (PE 30-36) (R076XY005KS)	4,000	3,000	2,000

Table 8.—Land Management, Part I (Planting)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting hazard	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:							
Smolan	90	Moderately suited Stickiness; high plasticity index	0.50	Moderately suited Stickiness; high plasticity index	0.50	Severe Low strength	1.00
1382810:							
Chase	90	Moderately suited Stickiness; high plasticity index	0.50	Moderately suited Stickiness; high plasticity index	0.50	Severe Low strength	1.00
1382811:							
Ivan	80	Well suited		Well suited		Severe Low strength	1.00
1382812:							
Ivan	85	Well suited		Well suited		Severe Low strength	1.00
1382813:							
Kahola	85	Well suited		Well suited		Severe Low strength	1.00
1382816:							
Clime	67	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index Slope	0.75 0.50	Severe Low strength	1.00
Sogn	30	Unsuited Restrictive layer Stickiness; high plasticity index	1.00 0.50	Unsuited Restrictive layer Slope Stickiness; high plasticity index	1.00 0.50 0.50	Severe Low strength	1.00
1382818:							
Dwight	85	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index	0.75	Severe Low strength	1.00
1382821:							
Florence	47	Moderately suited Rock fragments	0.50	Unsuited Rock fragments Slope	1.00 0.50	Severe Low strength	1.00
Labette	34	Moderately suited Stickiness; high plasticity index	0.50	Moderately suited Stickiness; high plasticity index Slope	0.50 0.50	Severe Low strength	1.00
1382822:							
Florence	70	Moderately suited Rock fragments	0.50	Unsuited Rock fragments Slope	1.00 0.50	Severe Low strength	1.00

Table 8.—Land Management, Part I (Planting)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting hazard	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382822:							
Matfield	25	Moderately suited Rock fragments	 0.50	Poorly suited Rock fragments	 0.75	Severe Low strength	 1.00
1382823:							
Irwin	85	Poorly suited Stickiness; high plasticity index	 0.75	Poorly suited Stickiness; high plasticity index	 0.75	Severe Low strength	 1.00
1382824:							
Irwin, eroded	95	Poorly suited Stickiness; high plasticity index	 0.75	Poorly suited Stickiness; high plasticity index	 0.75	Severe Low strength	 1.00
1382825:							
Irwin	90	Poorly suited Stickiness; high plasticity index	 0.75	Poorly suited Stickiness; high plasticity index	 0.75	Severe Low strength	 1.00
1382826:							
Irwin, eroded	90	Poorly suited Stickiness; high plasticity index	 0.75	Poorly suited Stickiness; high plasticity index	 0.75	Severe Low strength	 1.00
1382827:							
Labette	85	Moderately suited Stickiness; high plasticity index	 0.50	Moderately suited Stickiness; high plasticity index	 0.50	Severe Low strength	 1.00
1382828:							
Labette	85	Moderately suited Stickiness; high plasticity index	 0.50	Moderately suited Stickiness; high plasticity index	 0.50	Severe Low strength	 1.00
1382830:							
Labette	50	Moderately suited Stickiness; high plasticity index	 0.50	Moderately suited Stickiness; high plasticity index	 0.50	Severe Low strength	 1.00
Dwight	41	Poorly suited Stickiness; high plasticity index	 0.75	Poorly suited Stickiness; high plasticity index	 0.75	Severe Low strength	 1.00
1382831:							
Labette	47	Moderately suited Stickiness; high plasticity index	 0.50	Moderately suited Stickiness; high plasticity index Slope	 0.50 0.50	Severe Low strength	 1.00
Sogn	38	Unsuited Restrictive layer Stickiness; high plasticity index	 1.00 0.50	Unsuited Restrictive layer Slope Stickiness; high plasticity index	 1.00 0.50 0.50	Severe Low strength	 1.00
1382833:							
Tully	70	Poorly suited Stickiness; high plasticity index	 0.75	Poorly suited Stickiness; high plasticity index Slope	 0.75 0.50	Severe Low strength	 1.00

Table 8.—Land Management, Part I (Planting)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting hazard	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382834:							
Tully	85	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index Slope	0.75 0.50	Severe Low strength	1.00
1382835:							
Tully, eroded	85	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index Slope	0.75 0.50	Severe Low strength	1.00
1382836:							
Reading	85	Moderately suited Stickiness; high plasticity index	0.50	Moderately suited Stickiness; high plasticity index	0.50	Severe Low strength	1.00
1382837:							
Reading	90	Moderately suited Stickiness; high plasticity index	0.50	Moderately suited Stickiness; high plasticity index	0.50	Severe Low strength	1.00
1382839:							
Martin	85	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index	0.75	Severe Low strength	1.00
1382840:							
Martin, eroded	85	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index	0.75	Severe Low strength	1.00
1382841:							
Martin, eroded	80	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index Slope	0.75 0.50	Severe Low strength	1.00
Gullied land	20	Not rated		Not rated		Not rated	
1382845:							
Zaar	85	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index Slope	0.75 0.50	Severe Low strength	1.00
1382846:							
Zaar	55	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index	0.75	Severe Low strength	1.00
Dwight	45	Poorly suited Stickiness; high plasticity index	0.75	Poorly suited Stickiness; high plasticity index	0.75	Severe Low strength	1.00
1382849:							
Borrow pits	100	Not rated		Not rated		Not rated	
1382850:							
Gravel pits and quarries	100	Not rated		Not rated		Not rated	

Table 8.—Land Management, Part I (Planting)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting		Suitability for mechanical planting		Soil rutting hazard	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382851: Miscellaneous water-	100	Not rated		Not rated		Not rated	
1382852: Water	100	Not rated		Not rated		Not rated	

Table 8.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:							
Smolan	90	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
1382810:							
Chase	90	Slight		Slight		Poorly suited	
						Flooding	1.00
						Low strength	0.50
1382811:							
Ivan	80	Slight		Slight		Poorly suited	
						Flooding	1.00
						Low strength	0.50
1382812:							
Ivan	85	Slight		Slight		Poorly suited	
						Flooding	1.00
						Low strength	0.50
1382813:							
Kahola	85	Slight		Slight		Poorly suited	
						Flooding	1.00
						Low strength	0.50
1382816:							
Clime	67	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Stickiness; high plasticity index	0.50
Sogn	30	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
1382818:							
Dwight	85	Slight		Slight		Moderately suited	
						Low strength	0.50
1382821:							
Florence	47	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
						Slope	0.50
Labette	34	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
1382822:							
Florence	70	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Slope	0.50
						Low strength	0.50
Matfield	25	Slight		Slight		Moderately suited	
						Low strength	0.50

Table 8.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)—Continued

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382823:							
Irwin	85	Slight		Slight		Moderately suited Low strength	 0.50
1382824:							
Irwin, eroded	95	Slight		Slight		Moderately suited Low strength Stickiness; high plasticity index	 0.50 0.50
1382825:							
Irwin	90	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength	 0.50
1382826:							
Irwin, eroded	90	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength Stickiness; high plasticity index	 0.50 0.50
1382827:							
Labette	85	Slight		Slight		Moderately suited Low strength	 0.50
1382828:							
Labette	85	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength	 0.50
1382830:							
Labette	50	Slight		Slight		Moderately suited Low strength	 0.50
Dwight	41	Slight		Slight		Moderately suited Low strength	 0.50
1382831:							
Labette	47	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength	 0.50
Sogn	38	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength Slope	 0.50 0.50
1382833:							
Tully	70	Slight		Severe Slope/erodibility	 0.95	Moderately suited Slope Low strength Stickiness; high plasticity index	 0.50 0.50 0.50
1382834:							
Tully	85	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength Stickiness; high plasticity index	 0.50 0.50
1382835:							
Tully, eroded	85	Slight		Moderate Slope/erodibility	 0.50	Moderately suited Low strength Stickiness; high plasticity index	 0.50 0.50

Table 8.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)—Continued

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion		Hazard of erosion on roads and trails		Suitability for roads (natural surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382836:							
Reading	85	Slight		Slight		Moderately suited Low strength	0.50
1382837:							
Reading	90	Slight		Slight		Moderately suited Low strength	0.50
1382839:							
Martin	85	Slight		Moderate Slope/erodibility	0.50	Moderately suited Low strength Stickiness; high plasticity index	0.50 0.50
1382840:							
Martin, eroded	85	Slight		Moderate Slope/erodibility	0.50	Moderately suited Low strength Stickiness; high plasticity index	0.50 0.50
1382841:							
Martin, eroded	80	Slight		Moderate Slope/erodibility	0.50	Moderately suited Low strength Slope Stickiness; high plasticity index	0.50 0.50 0.50
Gullied land	20	Not rated		Not rated		Not rated	
1382845:							
Zaar	85	Slight		Moderate Slope/erodibility	0.50	Moderately suited Low strength Stickiness; high plasticity index Wetness	0.50 0.50 0.50
1382846:							
Zaar	55	Slight		Slight		Moderately suited Low strength Stickiness; high plasticity index Wetness	0.50 0.50 0.50
Dwight	45	Slight		Slight		Moderately suited Low strength	0.50
1382849:							
Borrow pits	100	Not rated		Not rated		Not rated	
1382850:							
Gravel pits and quarries	100	Not rated		Not rated		Not rated	
1382851:							
Miscellaneous water	100	Not rated		Not rated		Not rated	
1382852:							
Water	100	Not rated		Not rated		Not rated	

Table 8.—Land Management, Part III (Site Preparation)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep)		Suitability for mechanical site preparation (surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:					
Smolan	90	Well suited		Well suited	
1382810:					
Chase	90	Well suited		Well suited	
1382811:					
Ivan	80	Well suited		Well suited	
1382812:					
Ivan	85	Well suited		Well suited	
1382813:					
Kahola	85	Well suited		Well suited	
1382816:					
Clime	67	Well suited		Poorly suited	
				Stickiness; high plasticity index	0.50
Sogn	30	Unsuited		Unsuited	
		Restrictive layer	1.00	Restrictive layer	1.00
1382818:					
Dwight	85	Well suited		Poorly suited	
				Stickiness; high plasticity index	0.50
1382821:					
Florence	47	Poorly suited		Poorly suited	
		Rock fragments	0.50	Rock fragments	0.50
Labette	34	Well suited		Well suited	
1382822:					
Florence	70	Poorly suited		Poorly suited	
		Rock fragments	0.50	Rock fragments	0.50
Matfield	25	Poorly suited		Poorly suited	
		Rock fragments	0.50	Rock fragments	0.50
1382823:					
Irwin	85	Well suited		Poorly suited	
				Stickiness; high plasticity index	0.50
1382824:					
Irwin, eroded	95	Well suited		Poorly suited	
				Stickiness; high plasticity index	0.50

Table 8.—Land Management, Part III (Site Preparation)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep)		Suitability for mechanical site preparation (surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382825:					
Irwin	90	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382826:					
Irwin, eroded	90	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382827:					
Labette	85	Well suited		Well suited	
1382828:					
Labette	85	Well suited		Well suited	
1382830:					
Labette	50	Well suited		Well suited	
Dwight	41	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382831:					
Labette	47	Well suited		Well suited	
Sogn	38	Unsuited Restrictive layer	1.00	Unsuited Restrictive layer	1.00
1382833:					
Tully	70	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382834:					
Tully	85	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382835:					
Tully, eroded	85	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382836:					
Reading	85	Well suited		Well suited	
1382837:					
Reading	90	Well suited		Well suited	
1382839:					
Martin	85	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382840:					
Martin, eroded	85	Well suited		Poorly suited Stickiness; high plasticity index	0.50

Table 8.—Land Management, Part III (Site Preparation)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep)		Suitability for mechanical site preparation (surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382841:					
Martin, eroded	80	Well suited		Poorly suited Stickiness; high plasticity index	0.50
Gullied land	20	Not rated		Not rated	
1382845:					
Zaar	85	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382846:					
Zaar	55	Well suited		Poorly suited Stickiness; high plasticity index	0.50
Dwight	45	Well suited		Poorly suited Stickiness; high plasticity index	0.50
1382849:					
Borrow pits	100	Not rated		Not rated	
1382850:					
Gravel pits and quarries	100	Not rated		Not rated	
1382851:					
Miscellaneous water	100	Not rated		Not rated	
1382852:					
Water	100	Not rated		Not rated	

Table 8.—Land Management, Part IV (Site Restoration)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:					
Smolan	90	Low Texture/rock fragments	0.10	Low	
1382810:					
Chase	90	Low Texture/rock fragments	0.10	Low	
1382811:					
Ivan	80	Low Texture/rock fragments	0.10	Moderate Soil reaction	0.50
1382812:					
Ivan	85	Low Texture/rock fragments	0.10	Moderate Soil reaction	0.50
1382813:					
Kahola	85	Low Texture/rock fragments	0.10	Low	
1382816:					
Clime	67	Moderate Texture/rock fragments	0.50	High Available water Carbonate content	1.00 0.50
Sogn	30	Low Texture/rock fragments	0.10	High Available water	1.00
1382818:					
Dwight	85	Low Texture/rock fragments	0.10	Moderate Available water	0.50
1382821:					
Florence	47	Moderate Texture/surface depth/rock fragments	0.50	High Available water	1.00
Labette	34	Low Texture/rock fragments	0.10	Moderate Available water	0.50
1382822:					
Florence	70	Moderate Texture/surface depth/rock fragments	0.50	High Available water	1.00

Table 8.—Land Management, Part IV (Site Restoration)—Continued

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382822:					
Matfield	25	Low		High	
		Texture/rock fragments	0.10	Available water	1.00
1382823:					
Irwin	85	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
1382824:					
Irwin, eroded	95	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
1382825:					
Irwin	90	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
1382826:					
Irwin, eroded	90	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
1382827:					
Labette	85	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
1382828:					
Labette	85	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
1382830:					
Labette	50	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
Dwight	41	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
1382831:					
Labette	47	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
Sogn	38	Low		High	
		Texture/rock fragments	0.10	Available water	1.00
1382833:					
Tully	70	Moderate		Moderate	
		Texture/rock fragments	0.50	Available water	0.50
1382834:					
Tully	85	Moderate		Moderate	
		Texture/rock fragments	0.50	Available water	0.50

Table 8.—Land Management, Part IV (Site Restoration)—Continued

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382835:					
Tully, eroded	85	Moderate Texture/rock fragments	0.50	Moderate Available water	0.50
1382836:					
Reading	85	Low Texture/rock fragments	0.10	Low	
1382837:					
Reading	90	Low Texture/rock fragments	0.10	Low	
1382839:					
Martin	85	Moderate Texture/rock fragments	0.50	Low	
1382840:					
Martin, eroded	85	Moderate Texture/rock fragments	0.50	Low	
1382841:					
Martin, eroded	80	Moderate Texture/rock fragments	0.50	Low	
Gullied land	20	Not rated		Not rated	
1382845:					
Zaar	85	Moderate Texture/rock fragments	0.50	Low	
1382846:					
Zaar	55	Moderate Texture/rock fragments	0.50	Low	
Dwight	45	Low Texture/rock fragments	0.10	Moderate Available water	0.50
1382849:					
Borrow pits	100	Not rated		Not rated	
1382850:					
Gravel pits and quarries	100	Not rated		Not rated	
1382851:					
Miscellaneous water	100	Not rated		Not rated	
1382852:					
Water	100	Not rated		Not rated	

Table 9.—Recreation, Part I (Camp and Picnic Areas)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:					
Smolan	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
1382810:					
Chase	90	Very limited		Somewhat limited	
		Flooding	1.00	Slow water movement	0.94
		Slow water movement	0.94		
1382811:					
Ivan	80	Very limited		Somewhat limited	
		Flooding	1.00	Flooding	0.40
1382812:					
Ivan	85	Very limited		Not limited	
		Flooding	1.00		
1382813:					
Kahola	85	Very limited		Not limited	
		Flooding	1.00		
1382816:					
Clime	67	Somewhat limited		Somewhat limited	
		Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.39	Slow water movement	0.39
		Slope	0.04	Slope	0.04
Sogn	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
		Slope	0.04	Slope	0.04
1382818:					
Dwight	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45
1382821:					
Florence	47	Not limited		Not limited	
Labette	34	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
1382822:					
Florence	70	Somewhat limited		Somewhat limited	
		Slope	0.04	Slope	0.04

Table 9.—Recreation, Part I (Camp and Picnic Areas)—Continued

Map unit symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382822:					
Matfield	25	Somewhat limited		Somewhat limited	
		Gravel	0.92	Gravel	0.92
		Slow water movement	0.45	Slow water movement	0.45
1382823:					
Irwin	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45
1382824:					
Irwin, eroded	95	Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45
1382825:					
Irwin	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45
1382826:					
Irwin, eroded	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45
1382827:					
Labette	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
1382828:					
Labette	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
1382830:					
Labette	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
Dwight	41	Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45
1382831:					
Labette	47	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
Sogn	38	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to bedrock	1.00
1382833:					
Tully	70	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
		Slope	0.16	Slope	0.16

Table 9.—Recreation, Part I (Camp and Picnic Areas)—Continued

Map unit symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382834:					
Tully	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
1382835:					
Tully, eroded	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.39	Slow water movement	0.39
1382836:					
Reading	85	Very limited		Not limited	
		Flooding	1.00		
1382837:					
Reading	90	Very limited		Not limited	
		Flooding	1.00		
1382839:					
Martin	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.94	Slow water movement	0.94
1382840:					
Martin, eroded	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.94	Slow water movement	0.94
1382841:					
Martin, eroded	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.94	Slow water movement	0.94
Gullied land	20	Not rated		Not rated	
1382845:					
Zaar	85	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Too clayey	1.00	Too clayey	1.00
		Depth to saturated zone	0.98	Depth to saturated zone	0.75
1382846:					
Zaar	55	Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00
		Too clayey	1.00	Too clayey	1.00
		Depth to saturated zone	0.98	Depth to saturated zone	0.75
Dwight	45	Somewhat limited		Somewhat limited	
		Slow water movement	0.45	Slow water movement	0.45
1382849:					
Borrow pits	100	Not rated		Not rated	
1382850:					
Gravel pits and quarries	100	Not rated		Not rated	

Table 9.—Recreation, Part I (Camp and Picnic Areas)—Continued

Map unit symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382851: Miscellaneous water-	100	Not rated		Not rated	
1382852: Water	100	Not rated		Not rated	

Table 9.—Recreation, Part II (Trail Management)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails		Mountain bike and off-road vehicle trails	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:					
Smolan	90	Not limited		Not limited	
1382810:					
Chase	90	Not limited		Not limited	
1382811:					
Ivan	80	Somewhat limited Flooding	0.40	Somewhat limited Flooding	0.40
1382812:					
Ivan	85	Not limited		Not limited	
1382813:					
Kahola	85	Not limited		Not limited	
1382816:					
Clime	67	Somewhat limited Too clayey	0.50	Somewhat limited Too clayey	0.50
Sogn	30	Not limited		Not limited	
1382818:					
Dwight	85	Not limited		Not limited	
1382821:					
Florence	47	Not limited		Not limited	
Labette	34	Not limited		Not limited	
1382822:					
Florence	70	Not limited		Not limited	
Matfield	25	Not limited		Not limited	
1382823:					
Irwin	85	Not limited		Not limited	
1382824:					
Irwin, eroded	95	Not limited		Not limited	
1382825:					
Irwin	90	Not limited		Not limited	
1382826:					
Irwin, eroded	90	Not limited		Not limited	
1382827:					
Labette	85	Not limited		Not limited	
1382828:					
Labette	85	Not limited		Not limited	

Table 9.—Recreation, Part II (Trail Management)—Continued

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails		Mountain bike and off-road vehicle trails	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382830:					
Labette	50	Not limited		Not limited	
Dwight	41	Not limited		Not limited	
1382831:					
Labette	47	Not limited		Not limited	
Sogn	38	Not limited		Not limited	
1382833:					
Tully	70	Not limited		Not limited	
1382834:					
Tully	85	Not limited		Not limited	
1382835:					
Tully, eroded	85	Not limited		Not limited	
1382836:					
Reading	85	Not limited		Not limited	
1382837:					
Reading	90	Not limited		Not limited	
1382839:					
Martin	85	Not limited		Not limited	
1382840:					
Martin, eroded	85	Not limited		Not limited	
1382841:					
Martin, eroded	80	Not limited		Not limited	
Gullied land	20	Not rated		Not rated	
1382845:					
Zaar	85	Very limited		Very limited	
		Too clayey	1.00	Too clayey	1.00
		Depth to saturated zone	0.44	Depth to saturated zone	0.44
1382846:					
Zaar	55	Very limited		Very limited	
		Too clayey	1.00	Too clayey	1.00
		Depth to saturated zone	0.44	Depth to saturated zone	0.44
Dwight	45	Not limited		Not limited	
1382849:					
Borrow pits	100	Not rated		Not rated	
1382850:					
Gravel pits and quarries	100	Not rated		Not rated	

Table 9.—Recreation, Part II (Trail Management)—Continued

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails		Mountain bike and off-road vehicle trails	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382851: Miscellaneous water-	100	Not rated		Not rated	
1382852: Water	100	Not rated		Not rated	

Table 10.—Dwellings and Small Commercial Buildings

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:							
Smolan	90	Very limited Shrink-swell	 1.00	Very limited Shrink-swell	 1.00	Very limited Shrink-swell	 1.00
1382810:							
Chase	90	Very limited Flooding Shrink-swell	 1.00 1.00	Very limited Flooding Shrink-swell Depth to saturated zone	 1.00 1.00 0.95	Very limited Flooding Shrink-swell	 1.00 1.00
1382811:							
Ivan	80	Very limited Flooding Shrink-swell	 1.00 0.68	Very limited Flooding	 1.00	Very limited Flooding Shrink-swell	 1.00 0.68
1382812:							
Ivan	85	Very limited Flooding	 1.00	Very limited Flooding	 1.00	Very limited Flooding	 1.00
1382813:							
Kahola	85	Very limited Flooding Shrink-swell	 1.00 0.44	Very limited Flooding Shrink-swell	 1.00 0.44	Very limited Flooding Shrink-swell	 1.00 0.44
1382816:							
Clime	67	Somewhat limited Shrink-swell Slope	 0.32 0.04	Somewhat limited Shrink-swell Depth to soft bedrock Slope	 0.32 0.20 0.04	Very limited Slope Shrink-swell	 1.00 0.32
Sogn	30	Very limited Depth to hard bedrock Shrink-swell Slope	 1.00 0.68 0.04	Very limited Depth to hard bedrock Shrink-swell Slope	 1.00 0.68 0.04	Very limited Depth to hard bedrock Slope Shrink-swell	 1.00 1.00 0.68
1382818:							
Dwight	85	Very limited Shrink-swell	 1.00	Very limited Shrink-swell Depth to hard bedrock	 1.00 0.96	Very limited Shrink-swell	 1.00
1382821:							
Florence	47	Somewhat limited Large stones	 0.68	Somewhat limited Depth to hard bedrock Large stones	 0.96 0.68	Somewhat limited Slope Large stones	 0.88 0.68
Labette	34	Very limited Shrink-swell Depth to hard bedrock	 1.00 0.01	Very limited Shrink-swell Depth to hard bedrock	 1.00 1.00	Very limited Shrink-swell Slope Depth to hard bedrock	 1.00 0.12 0.01

Table 10.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382822:							
Florence	70	Somewhat limited		Somewhat limited		Very limited	
		Large stones	0.68	Depth to hard bedrock	0.96	Slope	1.00
		Slope	0.04	Large stones	0.68	Large stones	0.68
				Slope	0.04		
Matfield	25	Not limited		Not limited		Not limited	
1382823:							
Irwin	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1382824:							
Irwin, eroded	95	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1382825:							
Irwin	90	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1382826:							
Irwin, eroded	90	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1382827:							
Labette	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	0.01	Depth to hard bedrock	1.00	Depth to hard bedrock	0.01
1382828:							
Labette	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	0.01	Depth to hard bedrock	1.00	Depth to hard bedrock	0.01
1382830:							
Labette	50	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	0.01	Depth to hard bedrock	1.00	Depth to hard bedrock	0.01
Dwight	41	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
				Depth to hard bedrock	0.96		
1382831:							
Labette	47	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Depth to hard bedrock	0.01	Depth to hard bedrock	1.00	Slope	0.12
						Depth to hard bedrock	0.01
Sogn	38	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
		Shrink-swell	0.68	Shrink-swell	0.68	Slope	0.88
						Shrink-swell	0.68

Table 10.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382833:							
Tully	70	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
		Slope	0.16	Slope	0.16	Slope	1.00
1382834:							
Tully	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
						Slope	0.12
1382835:							
Tully, eroded	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
						Slope	0.12
1382836:							
Reading	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Shrink-swell	0.11	Shrink-swell	0.11	Shrink-swell	0.11
1382837:							
Reading	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Shrink-swell	0.11	Shrink-swell	0.11	Shrink-swell	0.11
1382839:							
Martin	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1382840:							
Martin, eroded	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1382841:							
Martin, eroded	80	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
						Slope	0.88
Gullied land	20	Not rated		Not rated		Not rated	
1382845:							
Zaar	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Depth to saturated zone	1.00	Shrink-swell	1.00
		Depth to saturated zone	0.98	Shrink-swell	1.00	Depth to saturated zone	0.98
						Slope	0.12
1382846:							
Zaar	55	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Depth to saturated zone	1.00	Shrink-swell	1.00
		Depth to saturated zone	0.98	Shrink-swell	1.00	Depth to saturated zone	0.98
Dwight	45	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
				Depth to hard bedrock	0.96		
1382849:							
Borrow pits	100	Not rated		Not rated		Not rated	

Table 10.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Dwellings without basements: Value	Dwellings with basements: Rating class and limiting features	Dwellings with basements: Value	Small commercial buildings: Rating class and limiting features	Small commercial buildings: Value
1382850: Gravel pits and quarries	100	Not rated		Not rated		Not rated	
1382851: Miscellaneous water	100	Not rated		Not rated		Not rated	
1382852: Water	100	Not rated		Not rated		Not rated	

Table 11.—Roads and Streets, Shallow Excavations, and Landscaping

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:							
Smolan	90	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Unstable excavation walls	0.10		
		Frost action	0.50	Too clayey	0.01		
1382810:							
Chase	90	Very limited		Somewhat limited		Somewhat limited	
		Shrink-swell	1.00	Depth to saturated zone	0.95	Flooding	0.60
		Frost action	1.00	Flooding	0.60		
		Flooding	1.00	Unstable excavation walls	0.10		
		Low strength	1.00	Too clayey	0.04		
1382811:							
Ivan	80	Very limited		Somewhat limited		Very limited	
		Flooding	1.00	Flooding	0.80	Flooding	1.00
		Low strength	1.00	Unstable excavation walls	0.10		
		Shrink-swell	0.68				
		Frost action	0.50				
1382812:							
Ivan	85	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Flooding	0.60	Flooding	0.60
		Low strength	1.00	Unstable excavation walls	0.10		
		Frost action	0.50				
1382813:							
Kahola	85	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Flooding	0.60	Flooding	0.60
		Low strength	1.00	Unstable excavation walls	0.10		
		Frost action	0.50				
		Shrink-swell	0.44				
1382816:							
Clime	67	Somewhat limited		Somewhat limited		Very limited	
		Frost action	0.50	Too clayey	0.32	Too clayey	1.00
		Shrink-swell	0.32	Depth to soft bedrock	0.20	Depth to bedrock	0.20
		Slope	0.04	Unstable excavation walls	0.10	Slope	0.04
				Slope	0.04	Droughty	0.03
Sogn	30	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Shrink-swell	0.68	Unstable excavation walls	0.50	Droughty	1.00
		Frost action	0.50			Slope	0.04
		Slope	0.04	Slope	0.04		

Table 11.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382818:							
Dwight	85	Very limited		Very limited		Not limited	
		Shrink-swell	1.00	Too clayey	1.00		
		Frost action	0.50	Depth to hard bedrock	0.96		
				Unstable excavation walls	0.10		
1382821:							
Florence	47	Somewhat limited		Very limited		Very limited	
		Large stones	0.68	Unstable excavation walls	1.00	Droughty	1.00
		Frost action	0.50	Depth to hard bedrock	0.96		
				Too clayey	0.68		
				Large stones	0.68		
Labette	34	Very limited		Very limited		Somewhat limited	
		Shrink-swell	1.00	Depth to hard bedrock	1.00	Depth to bedrock	0.01
		Low strength	1.00	Too clayey	0.18		
		Frost action	0.50	Unstable excavation walls	0.10		
		Depth to hard bedrock	0.01				
1382822:							
Florence	70	Somewhat limited		Very limited		Very limited	
		Large stones	0.68	Unstable excavation walls	1.00	Droughty	1.00
		Frost action	0.50			Slope	0.04
		Slope	0.04	Depth to hard bedrock	0.96		
				Too clayey	0.68		
				Large stones	0.68		
				Slope	0.04		
Matfield	25	Somewhat limited		Very limited		Somewhat limited	
		Frost action	0.50	Unstable excavation walls	1.00	Gravel	0.92
				Too clayey	1.00	Droughty	0.81
1382823:							
Irwin	85	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.18		
		Frost action	0.50	Unstable excavation walls	0.10		
1382824:							
Irwin, eroded	95	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.18		
		Low strength	1.00	Unstable excavation walls	0.10		
		Frost action	0.50				
1382825:							
Irwin	90	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.18		
		Frost action	0.50	Unstable excavation walls	0.10		

Table 11.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382826:							
Irwin, eroded	90	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.18		
		Low strength	1.00	Unstable excavation walls	0.10		
		Frost action	0.50				
1382827:							
Labette	85	Very limited		Very limited		Somewhat limited	
		Shrink-swell	1.00	Depth to hard bedrock	1.00	Depth to bedrock	0.01
		Low strength	1.00	Too clayey	0.18		
		Frost action	0.50	Unstable excavation walls	0.10		
		Depth to hard bedrock	0.01				
1382828:							
Labette	85	Very limited		Very limited		Somewhat limited	
		Shrink-swell	1.00	Depth to hard bedrock	1.00	Depth to bedrock	0.01
		Low strength	1.00	Too clayey	0.18		
		Frost action	0.50	Unstable excavation walls	0.10		
		Depth to hard bedrock	0.01				
1382830:							
Labette	50	Very limited		Very limited		Somewhat limited	
		Shrink-swell	1.00	Depth to hard bedrock	1.00	Depth to bedrock	0.01
		Low strength	1.00	Too clayey	0.18		
		Frost action	0.50	Unstable excavation walls	0.10		
		Depth to hard bedrock	0.01				
Dwight	41	Very limited		Very limited		Not limited	
		Shrink-swell	1.00	Too clayey	1.00		
		Frost action	0.50	Depth to hard bedrock	0.96		
				Unstable excavation walls	0.10		
1382831:							
Labette	47	Very limited		Very limited		Somewhat limited	
		Shrink-swell	1.00	Depth to hard bedrock	1.00	Depth to bedrock	0.01
		Low strength	1.00	Too clayey	0.18		
		Frost action	0.50	Unstable excavation walls	0.10		
		Depth to hard bedrock	0.01				
Sogn	38	Very limited		Very limited		Very limited	
		Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
		Shrink-swell	0.68	Unstable excavation walls	0.50	Droughty	1.00
		Frost action	0.50				
1382833:							
Tully	70	Very limited		Very limited		Somewhat limited	
		Shrink-swell	1.00	Unstable excavation walls	1.00	Slope	0.16
		Low strength	1.00	Too clayey	0.68	Droughty	0.09
		Frost action	0.50	Slope	0.16		
		Slope	0.16				

Table 11.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382834:							
Tully	85	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.68		
		Low strength	1.00	Unstable excavation walls	0.10		
		Frost action	0.50				
1382835:							
Tully, eroded	85	Very limited		Somewhat limited		Somewhat limited	
		Shrink-swell	1.00	Too clayey	0.68	Droughty	0.04
		Low strength	1.00	Unstable excavation walls	0.10		
		Frost action	0.50				
1382836:							
Reading	85	Very limited		Somewhat limited		Not limited	
		Frost action	1.00	Unstable excavation walls	0.10		
		Low strength	1.00				
		Flooding	0.40				
		Shrink-swell	0.11				
1382837:							
Reading	90	Very limited		Somewhat limited		Not limited	
		Frost action	1.00	Unstable excavation walls	0.10		
		Low strength	1.00				
		Flooding	0.40				
		Shrink-swell	0.11				
1382839:							
Martin	85	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.68		
		Frost action	1.00	Unstable excavation walls	0.10		
		Low strength	1.00				
1382840:							
Martin, eroded	85	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.68		
		Frost action	1.00	Unstable excavation walls	0.10		
		Low strength	1.00				
1382841:							
Martin, eroded	80	Very limited		Somewhat limited		Not limited	
		Shrink-swell	1.00	Too clayey	0.68		
		Frost action	1.00	Unstable excavation walls	0.10		
		Low strength	1.00				
Gullied land	20	Not rated		Not rated		Not rated	
1382845:							
Zaar	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Depth to saturated zone	1.00	Too clayey	1.00
		Depth to saturated zone	0.75	Too clayey	0.92	Depth to saturated zone	0.75
				Unstable excavation walls	0.10		
1382846:							
Zaar	55	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Depth to saturated zone	1.00	Too clayey	1.00
		Depth to saturated zone	0.75	Too clayey	0.92	Depth to saturated zone	0.75
				Unstable excavation walls	0.10		

Table 11.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382846:							
Dwight	45	Very limited		Very limited		Not limited	
		Shrink-swell	1.00	Too clayey	1.00		
		Frost action	0.50	Depth to hard bedrock	0.96		
				Unstable excavation walls	0.10		
1382849:							
Borrow pits	100	Not rated		Not rated		Not rated	
1382850:							
Gravel pits and quarries	100	Not rated		Not rated		Not rated	
1382851:							
Miscellaneous water	100	Not rated		Not rated		Not rated	
1382852:							
Water	100	Not rated		Not rated		Not rated	

Table 12.—Sewage Disposal

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:					
Smolan	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.32
1382810:					
Chase	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Depth to saturated zone	1.00		
		Slow water movement	1.00		
1382811:					
Ivan	80	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
1382812:					
Ivan	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
1382813:					
Kahola	85	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
1382816:					
Clime	67	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Slope	0.04		
Sogn	30	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	0.04	Slope	1.00
1382818:					
Dwight	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Depth to hard bedrock	0.96
		Depth to bedrock	0.98		

Table 12.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382821:					
Florence	47	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Depth to bedrock	0.98	Depth to hard bedrock	0.96
		Large stones	0.68	Large stones	0.48
Labette	34	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00	Slope	0.68
1382822:					
Florence	70	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Depth to bedrock	0.98	Depth to hard bedrock	0.96
		Large stones	0.68	Large stones	0.48
		Slope	0.04		
Matfield	25	Very limited		Very limited	
		Slow water movement	1.00	Seepage	1.00
				Slope	0.08
1382823:					
Irwin	85	Very limited		Not limited	
		Slow water movement	1.00		
1382824:					
Irwin, eroded	95	Very limited		Not limited	
		Slow water movement	1.00		
1382825:					
Irwin	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.32
1382826:					
Irwin, eroded	90	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.32
1382827:					
Labette	85	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00		
1382828:					
Labette	85	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00	Slope	0.32

Table 12.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382830:					
Labette	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00		
Dwight	41	Very limited		Somewhat limited	
		Slow water movement	1.00	Depth to hard bedrock	0.96
		Depth to bedrock	0.98		
1382831:					
Labette	47	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00	Slope	0.68
Sogn	38	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
				Slope	1.00
1382833:					
Tully	70	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	0.16	Seepage	0.32
1382834:					
Tully	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.68
				Seepage	0.32
1382835:					
Tully, eroded	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.68
1382836:					
Reading	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.68	Seepage	0.50
		Flooding	0.40	Flooding	0.40
1382837:					
Reading	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.68	Seepage	0.50
		Flooding	0.40	Flooding	0.40
1382839:					
Martin	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.32
1382840:					
Martin, eroded	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.32

Table 12.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382841:					
Martin, eroded	80	Very limited Slow water movement	1.00	Very limited Slope	1.00
Gullied land	20	Not rated		Not rated	
1382845:					
Zaar	85	Very limited Depth to saturated zone Slow water movement	1.00 1.00	Very limited Depth to saturated zone Slope	1.00 0.68
1382846:					
Zaar	55	Very limited Depth to saturated zone Slow water movement	1.00 1.00	Very limited Depth to saturated zone	1.00
Dwight	45	Very limited Slow water movement Depth to bedrock	1.00 0.98	Somewhat limited Depth to hard bedrock	0.96
1382849:					
Borrow pits	100	Not rated		Not rated	
1382850:					
Gravel pits and quarries	100	Not rated		Not rated	
1382851:					
Miscellaneous water	100	Not rated		Not rated	
1382852:					
Water	100	Not rated		Not rated	

Table 13.—Source of Gravel and Sand

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Gravel source		Sand source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:					
Smolan	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382810:					
Chase	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382811:					
Ivan	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382812:					
Ivan	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382813:					
Kahola	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382816:					
Clime	67	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Sogn	30	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382818:					
Dwight	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382821:					
Florence	47	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Labette	34	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 13.—Source of Gravel and Sand—Continued

Map unit symbol and soil name	Pct. of map unit	Gravel source		Sand source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382822:					
Florence	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Matfield	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382823:					
Irwin	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382824:					
Irwin, eroded	95	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382825:					
Irwin	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382826:					
Irwin, eroded	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382827:					
Labette	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382828:					
Labette	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382830:					
Labette	50	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Dwight	41	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382831:					
Labette	47	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Sogn	38	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 13.—Source of Gravel and Sand—Continued

Map unit symbol and soil name	Pct. of map unit	Gravel source		Sand source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382833:					
Tully	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382834:					
Tully	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382835:					
Tully, eroded	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382836:					
Reading	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382837:					
Reading	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382839:					
Martin	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382840:					
Martin, eroded	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382841:					
Martin, eroded	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Gullied land	20	Not rated		Not rated	
1382845:					
Zaar	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382846:					
Zaar	55	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Dwight	45	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1382849:					
Borrow pits	100	Not rated		Not rated	

Table 13.—Source of Gravel and Sand—Continued

Map unit symbol and soil name	Pct. of map unit	Gravel source		Sand source	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1382850: Gravel pits and quarries	100	Not rated		Not rated	
1382851: Miscellaneous water-	100	Not rated		Not rated	
1382852: Water	100	Not rated		Not rated	

Table 14.—Source of Reclamation Material, Roadfill, and Topsoil

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material		Roadfill source		Topsoil source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:							
Smolan	90	Poor		Fair		Poor	
		Too clayey	0.00	Shrink-swell	0.27	Too clayey	0.00
		Water erosion	0.99				
1382810:							
Chase	90	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Water erosion	0.99	Shrink-swell	0.07		
1382811:							
Ivan	80	Fair		Poor		Good	
		Organic matter content low	0.88	Low strength	0.00		
1382812:							
Ivan	85	Good		Poor		Good	
				Low strength	0.00		
1382813:							
Kahola	85	Fair		Poor		Good	
		Organic matter content low	0.88	Low strength	0.00		
				Shrink-swell	0.89		
1382816:							
Clime	67	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.13	Shrink-swell	0.68	Depth to bedrock	0.79
		Depth to bedrock	0.79			Slope	0.96
Sogn	30	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00			Too clayey	0.93
		Too clayey	0.98			Slope	0.96
1382818:							
Dwight	85	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Too acid	0.84	Depth to bedrock	0.04	Sodium content	0.98
		Water erosion	0.90				
1382821:							
Florence	47	Poor		Poor		Poor	
		Too clayey	0.00	Cobble content	0.00	Too clayey	0.00
		Droughty	0.00	Depth to bedrock	0.04	Hard to reclaim (rock fragments)	0.00
		Cobble content	0.27			Rock fragments	0.00
Labette	34	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.36	Low strength	0.00	Depth to bedrock	0.99
		Water erosion	0.99	Shrink-swell	0.00		

Table 14.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material		Roadfill source		Topsoil source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382822:							
Florence	70	Poor		Poor		Poor	
		Too clayey	0.00	Cobble content	0.00	Too clayey	0.00
		Droughty	0.00	Depth to bedrock	0.04	Hard to reclaim (rock fragments)	0.00
		Cobble content	0.27			Rock fragments	0.00
Matfield	25	Fair		Fair		Poor	
		Droughty	0.17	Cobble content	0.98	Hard to reclaim (rock fragments)	0.00
						Rock fragments	0.00
1382823:							
Irwin	85	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Water erosion	0.99				
1382824:							
Irwin, eroded	95	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Water erosion	0.99	Shrink-swell	0.00		
1382825:							
Irwin	90	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Water erosion	0.99				
1382826:							
Irwin, eroded	90	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Water erosion	0.99	Shrink-swell	0.00		
1382827:							
Labette	85	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.36	Low strength	0.00	Depth to bedrock	0.99
		Water erosion	0.99	Shrink-swell	0.00		
1382828:							
Labette	85	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.36	Low strength	0.00	Depth to bedrock	0.99
		Water erosion	0.99	Shrink-swell	0.00		
1382830:							
Labette	50	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.36	Low strength	0.00	Depth to bedrock	0.99
		Water erosion	0.99	Shrink-swell	0.00		
Dwight	41	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Too acid	0.84	Depth to bedrock	0.04	Sodium content	0.98
		Water erosion	0.90				
1382831:							
Labette	47	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Droughty	0.36	Low strength	0.00	Depth to bedrock	0.99
		Water erosion	0.99	Shrink-swell	0.00		

Table 14.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material		Roadfill source		Topsoil source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382831:							
Sogn	38	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Depth to bedrock	0.00
		Depth to bedrock	0.00			Too clayey	0.93
		Too clayey	0.98				
1382833:							
Tully	70	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Droughty	0.71	Shrink-swell	0.03	Rock fragments	0.32
		Water erosion	0.99			Slope	0.84
1382834:							
Tully	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Droughty	0.97	Shrink-swell	0.02		
		Water erosion	0.99				
1382835:							
Tully, eroded	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Droughty	0.78	Shrink-swell	0.01		
		Water erosion	0.99				
1382836:							
Reading	85	Fair		Poor		Good	
		Water erosion	0.90	Low strength	0.00		
		Too acid	0.95	Shrink-swell	0.93		
1382837:							
Reading	90	Fair		Poor		Good	
		Water erosion	0.90	Low strength	0.00		
		Too acid	0.95	Shrink-swell	0.93		
1382839:							
Martin	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Too acid	0.95	Shrink-swell	0.21		
		Water erosion	0.99				
1382840:							
Martin, eroded	85	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Too acid	0.95	Shrink-swell	0.16		
		Water erosion	0.99				
1382841:							
Martin, eroded	80	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
		Too acid	0.95	Shrink-swell	0.16		
		Water erosion	0.99				
Gullied land	20	Not rated		Not rated		Not rated	
1382845:							
Zaar	85	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Too acid	0.95	Wetness depth	0.14	Wetness depth	0.14

Table 14.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material		Roadfill source		Topsoil source	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382846:							
Zaar	55	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Too acid	0.95	Wetness depth	0.14	Wetness depth	0.14
Dwight	45	Poor		Poor		Poor	
		Too clayey	0.00	Shrink-swell	0.00	Too clayey	0.00
		Too acid	0.84	Depth to bedrock	0.04	Sodium content	0.98
		Water erosion	0.90				
1382849:							
Borrow pits	100	Not rated		Not rated		Not rated	
1382850:							
Gravel pits and quarries	100	Not rated		Not rated		Not rated	
1382851:							
Miscellaneous water	100	Not rated		Not rated		Not rated	
1382852:							
Water	100	Not rated		Not rated		Not rated	

Table 15.—Ponds and Embankments

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382809:							
Smolan	90	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.08	Hard to pack	0.21	Depth to water	1.00
1382810:							
Chase	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.05	Hard to pack	0.83	Depth to water	1.00
				Depth to saturated zone	0.43		
1382811:							
Ivan	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.03	Depth to water	1.00
1382812:							
Ivan	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.15	Depth to water	1.00
1382813:							
Kahola	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			Depth to water	1.00
1382816:							
Clime	67	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Thin layer	0.77	Depth to water	1.00
		Depth to bedrock	0.06	hard to pack	0.63		
Sogn	30	Very limited		Very limited		Very limited	
		Depth to bedrock	1.00	Thin layer	1.00	Depth to water	1.00
		Slope	1.00				
1382818:							
Dwight	85	Somewhat limited		Very limited		Very limited	
		Depth to bedrock	0.37	Hard to pack	1.00	Depth to water	1.00
				Thin layer	0.37		
1382821:							
Florence	47	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.92	Large stones	0.68	Depth to water	1.00
		Depth to bedrock	0.37	Seepage	0.54		
		Seepage	0.05	Thin layer	0.37		
Labette	34	Somewhat limited		Somewhat limited		Very limited	
		Depth to bedrock	0.56	Hard to pack	0.58	Depth to water	1.00
		Slope	0.32	Thin layer	0.56		
1382822:							
Florence	70	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Large stones	0.68	Depth to water	1.00
		Depth to bedrock	0.37	Seepage	0.54		
		Seepage	0.05	Thin layer	0.37		
Matfield	25	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.46	Depth to water	1.00

Table 15.—Ponds and Embankments—Continued

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382823:							
Irwin	85	Not limited		Very limited Hard to pack	1.00	Very limited Depth to water	1.00
1382824:							
Irwin, eroded	95	Not limited		Very limited Hard to pack	1.00	Very limited Depth to water	1.00
1382825:							
Irwin	90	Somewhat limited Slope	0.08	Very limited Hard to pack	1.00	Very limited Depth to water	1.00
1382826:							
Irwin, eroded	90	Somewhat limited Slope	0.08	Very limited Hard to pack	1.00	Very limited Depth to water	1.00
1382827:							
Labette	85	Somewhat limited Depth to bedrock	0.56	Somewhat limited Hard to pack Thin layer	0.58 0.56	Very limited Depth to water	1.00
1382828:							
Labette	85	Somewhat limited Depth to bedrock Slope	0.56 0.08	Somewhat limited Hard to pack Thin layer	0.58 0.56	Very limited Depth to water	1.00
1382830:							
Labette	50	Somewhat limited Depth to bedrock	0.56	Somewhat limited Hard to pack Thin layer	0.58 0.56	Very limited Depth to water	1.00
Dwight	41	Somewhat limited Depth to bedrock	0.37	Very limited Hard to pack Thin layer	1.00 0.37	Very limited Depth to water	1.00
1382831:							
Labette	47	Somewhat limited Depth to bedrock Slope	0.56 0.32	Somewhat limited Hard to pack Thin layer	0.58 0.56	Very limited Depth to water	1.00
Sogn	38	Very limited Depth to bedrock Slope	1.00 0.92	Very limited Seepage Thin layer	1.00 1.00	Very limited Depth to water	1.00
1382833:							
Tully	70	Very limited Slope	1.00	Somewhat limited Hard to pack	0.98	Very limited Depth to water	1.00
1382834:							
Tully	85	Somewhat limited Slope	0.32	Somewhat limited Hard to pack	0.95	Very limited Depth to water	1.00
1382835:							
Tully, eroded	85	Somewhat limited Slope	0.32	Somewhat limited Hard to pack	0.98	Very limited Depth to water	1.00
1382836:							
Reading	85	Somewhat limited Seepage	0.57	Not limited		Very limited Depth to water	1.00

Table 15.—Ponds and Embankments—Continued

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1382837:							
Reading	90	Somewhat limited		Not limited		Very limited	
		Seepage	0.57			Depth to water	1.00
1382839:							
Martin	85	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.08	Hard to pack	0.88	Depth to water	1.00
1382840:							
Martin, eroded	85	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.08	Hard to pack	0.91	Depth to water	1.00
1382841:							
Martin, eroded	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.92	Hard to pack	0.91	Depth to water	1.00
Gullied land	20	Not rated		Not rated		Not rated	
1382845:							
Zaar	85	Somewhat limited		Very limited		Very limited	
		Slope	0.32	Depth to saturated zone	1.00	Depth to water	1.00
				Hard to pack	1.00		
1382846:							
Zaar	55	Not limited		Very limited		Very limited	
				Depth to saturated zone	1.00	Depth to water	1.00
				Hard to pack	1.00		
Dwight	45	Somewhat limited		Very limited		Very limited	
		Depth to bedrock	0.37	Hard to pack	1.00	Depth to water	1.00
				Thin layer	0.37		
1382849:							
Borrow pits	100	Not rated		Not rated		Not rated	
1382850:							
Gravel pits and quarries	100	Not rated		Not rated		Not rated	
1382851:							
Miscellaneous water-	100	Not rated		Not rated		Not rated	
1382852:							
Water	100	Not rated		Not rated		Not rated	

Table 16.—Engineering Properties

(Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 in	3-10 in	4	10	40	200		
	In				Pct	Pct					Pct	
1382809:												
Smolan	0-15	Silty clay loam	CL, CH, MH	A-7, A-7-6	0	0	100	100	95-100	85-100	41-55	19-25
	15-19	Silty clay loam	CL, CH	A-7-6, A-6	0	0	100	100	95-100	85-100	39-55	19-28
	19-42	Silty clay loam, silty clay	CL, CH	A-7-6	0	0	98-100	98-100	95-100	90-100	46-64	25-36
	42-60	Silty clay loam, silty clay	CL, CH	A-7-6	0	0	100	100	95-100	90-100	41-53	21-29
1382810:												
Chase	0-14	Silty clay loam, silt loam	CH, CL	A-7-6, A-6	0	0	100	100	95-100	90-100	40-53	17-25
	14-20	Silty clay loam	CH, CL	A-7-6	0	0	100	100	95-100	90-100	45-57	23-29
	20-46	Silty clay, silty clay loam, clay	CL, CH	A-7-6	0	0	100	100	95-100	90-100	47-69	25-45
	46-60	Silty clay, silty clay loam, clay	CL, CH	A-7, A-7-5, A-7-6	0	0	100	100	95-100	90-100	48-71	25-40
1382811:												
Ivan	0-20	Silt loam	CL-ML, CL	A-6, A-7-6, A-4	0	0	95-100	95-100	90-100	70-100	25-41	7-20
	20-35	Silt loam, silty clay loam	CL-ML, CL	A-7-6, A-6, A-4	0	0	95-100	95-100	90-100	65-100	25-45	7-25
	35-60	Silt loam, silty clay loam, loam	CL-ML, CL	A-7-6, A-6, A-4	0	0	95-100	95-100	90-100	65-100	25-45	7-25
1382812:												
Ivan	0-17	Silt loam	CL, CL-ML	A-6, A-7-6, A-4	0	0	95-100	95-100	90-100	70-100	25-41	7-20
	17-32	Silt loam, silty clay loam	CL-ML, CL	A-4, A-6, A-7-6	0	0	95-100	95-100	90-100	65-100	25-45	7-25
	32-60	Silt loam, silty clay loam	CL, CL-ML	A-7-6, A-6, A-4	0	0	95-100	95-100	90-100	65-100	25-45	7-25
1382813:												
Kahola	0-17	Silt loam	CL, ML	A-7-6, A-6	0	0	100	100	95-100	91-100	33-47	12-19
	17-25	Silt loam, loam, silty clay loam	CL, CH	A-7-6, A-6, A-4	0	0	100	100	81-100	72-92	28-56	10-28
	25-35	Silt loam, loam, silty clay loam	CL, CH	A-7-6, A-6, A-4	0	0	100	100	94-100	82-100	28-51	10-25
	35-60	Silt loam, loam, silty clay loam	CL, CH	A-7-6, A-6, A-4	0	0	100	100	90-100	73-93	28-51	10-25

Table 16.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 in	3-10 in	4	10	40	200		
	In				Pct	Pct					Pct	
1382816:												
Clime	0-9	Silty clay	CH, MH	A-7, A-7-5, A-7-6	0	0	90-100	90-100	85-100	80-99	50-70	25-35
	9-26	Silty clay, clay, silty clay loam	CL, CH	A-7-6	0	0	95-100	95-100	95-100	85-99	45-65	20-40
	26-33	Silty clay, clay, silty clay loam	CL, CH	A-7-6	0	0	95-100	95-100	95-100	85-99	45-61	20-35
	33-37	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
Sogn	0-7	Silty clay loam	MH, CL, CH	A-6, A-7-6, A-4, A-7	0	0	85-100	85-100	85-100	70-100	25-55	10-25
	7-11	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
1382818:												
Dwight	0-5	Silt loam	CL	A-7-6, A-6	0	0	100	100	95-100	85-100	33-47	12-20
	5-32	Clay, silty clay	CH	A-7-6, A-7	0	0	100	95-100	90-100	85-100	56-74	32-44
	32-42	Clay, silty clay, silty clay loam	CH, CL	A-7-6	0	0	95-100	85-100	85-100	80-100	46-69	25-46
	42-46	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
1382821:												
Florence	0-3	Gravelly silt loam	MH, ML	A-7-5, A-7, A-6, A-7-6	0	0-9	57-90	57-90	54-90	50-88	37-55	12-18
	3-13	Extremely gravelly silt loam, very gravelly silty clay loam, gravelly silty clay loam	SC, GP-GC, SM, GM, CL, SP-SC, GC, ML, MH	A-7, A-6, A-2-6, A-2-7, A-7-6, A-7-5	0	21-41	8-63	8-63	8-63	7-62	33-53	12-19
	13-20	Extremely gravelly silty clay loam, extremely cobbly clay, gravelly clay, very gravelly clay	SC, SP-SC, GP-GC, CL, GC	A-6, A-2-6, A-2-7, A-7-6	0	21-41	8-63	8-63	7-63	7-60	36-55	19-29
	20-42	Extremely cobbly clay, gravelly clay, very gravelly clay	CL, SC, GP-GC, CH, GC, SP-SC	A-7-6, A-2-7	0	28-62	12-69	12-69	11-69	10-69	48-88	32-59
	42-46	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
Labette	0-10	Silty clay loam	MH, CH, ML, CL	A-6, A-7-6, A-7-5, A-7	0	0	100	100	96-100	90-100	39-62	17-27
	10-15	Silty clay loam	CH, CL	A-7-6	0	0	100	100	93-100	88-97	42-57	21-28
	15-34	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	90-100	87-100	47-69	25-40
	34-38	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	91-100	91-100	79-100	76-98	46-63	25-36
	38-42	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---

Table 16.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 in	3-10 in	4	10	40	200		
	In				Pct	Pct					Pct	
1382822:												
Florence--------	0-3	Gravelly silt loam	ML, MH	A-6, A-7-6, A-7-5, A-7	0	0-9	57-90	57-90	54-90	50-88	37-55	12-18
	3-13	Extremely gravelly silt loam, very gravelly silty clay loam, gravelly silty clay loam	SC, GP-GC, SM, GM, CL, ML, MH, SP-SC, GC	A-7, A-6, A-2-6, A-2-7, A-7-6, A-7-5	0	21-41	8-63	8-63	8-63	7-62	33-53	12-19
	13-20	Extremely gravelly silty clay loam, extremely cobbly clay, gravelly clay, very gravelly clay	SC, SP-SC, GP-GC, CL, GC	A-6, A-2-6, A-2-7, A-7-6	0	21-41	8-63	8-63	7-63	7-60	36-55	19-29
	20-42	Extremely cobbly clay, gravelly clay, very gravelly clay	CH, GC, SP-SC, CL, SC, GP-GC	A-7-6, A-2-7	0	28-62	12-69	12-69	11-69	10-69	48-88	32-59
	42-46	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
Matfield--------	0-12	Gravelly silt loam	MH, ML, GM, SM	A-7-5, A-7-6, A-6, A-7	0	0-8	44-90	44-90	43-90	41-90	36-51	11-18
	12-22	Extremely gravelly silt loam	GM, GC	A-2-6, A-2-7, A-2-4, A-2-5	0	0-6	19-34	19-34	18-34	18-34	29-49	9-18
	22-46	Extremely gravelly silt loam	GC	A-2-6, A-2-5, A-2-4, A-4, A-2-7, A-7-6, A-6	0	32-42	9-43	9-43	8-42	8-41	22-42	9-19
	46-60	Extremely cobbly clay	GC	A-2-6, A-7-6, A-2-7	0	37-47	10-40	10-40	9-40	8-40	40-85	32-58
1382823:												
Irwin-----------	0-11	Silty clay loam	CL, CH	A-7-6, A-6	0	0	100	95-100	90-100	80-100	40-55	19-29
	11-38	Silty clay, clay	CH	A-7-6	0	0	100	95-100	95-100	85-100	51-76	29-46
	38-53	Silty clay, clay	CH	A-7-6	0	0	100	95-100	95-100	85-100	50-72	29-49
	53-60	Silty clay, clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	95-100	80-100	46-65	25-43
1382824:												
Irwin, eroded---	0-5	Silty clay loam	CL, CH	A-7-6, A-6	0	0	100	95-100	90-100	80-100	40-55	19-29
	5-38	Silty clay, clay	CH	A-7-6	0	0	100	95-100	95-100	85-100	51-76	29-46
	38-53	Silty clay, clay	CH	A-7-6	0	0	100	95-100	95-100	85-100	50-72	29-49
	53-60	Silty clay, clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	95-100	80-100	46-65	25-43

Table 16.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 in	3-10 in	4	10	40	200		
	In				Pct	Pct					Pct	
1382825:												
Irwin	0-11	Silty clay loam	CL, CH	A-7-6, A-6	0	0	100	95-100	90-100	80-100	40-55	19-29
	11-38	Silty clay, clay	CH	A-7-6	0	0	100	95-100	95-100	85-100	51-76	29-46
	38-53	Silty clay, clay	CH	A-7-6	0	0	100	95-100	95-100	85-100	50-72	29-49
	53-60	Silty clay, clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	95-100	80-100	46-65	25-43
1382826:												
Irwin, eroded	0-4	Silty clay loam, silty clay	CL, CH	A-7-6	0	0	100	95-100	90-100	80-98	45-59	21-30
	4-53	Silty clay, clay	CH	A-7-6	0	0	100	95-100	95-100	85-98	51-74	29-46
	53-60	Silty clay, clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	95-100	80-98	48-68	27-43
1382827:												
Labette	0-10	Silty clay loam	MH, CH, ML, CL	A-6, A-7-6, A-7-5, A-7	0	0	100	100	96-100	90-100	39-62	17-27
	10-15	Silty clay loam	CH, CL	A-7-6	0	0	100	100	93-100	88-97	42-57	21-28
	15-34	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	90-100	87-100	47-69	25-40
	34-38	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	91-100	91-100	79-100	76-98	46-63	25-36
	38-42	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
1382828:												
Labette	0-10	Silty clay loam	MH, CH, ML, CL	A-6, A-7-6, A-7-5, A-7	0	0	100	100	96-100	90-100	39-62	17-27
	10-15	Silty clay loam	CH, CL	A-7-6	0	0	100	100	93-100	88-97	42-57	21-28
	15-34	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	90-100	87-100	47-69	25-40
	34-38	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	91-100	91-100	79-100	76-98	46-63	25-36
	38-42	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
1382830:												
Labette	0-10	Silty clay loam	MH, CH, ML, CL	A-6, A-7-6, A-7-5, A-7	0	0	100	100	96-100	90-100	39-62	17-27
	10-15	Silty clay loam	CH, CL	A-7-6	0	0	100	100	93-100	88-97	42-57	21-28
	15-34	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	90-100	87-100	47-69	25-40
	34-38	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	91-100	91-100	79-100	76-98	46-63	25-36
	38-42	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---

Table 16.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 in	3-10 in	4	10	40	200		
	In				Pct	Pct					Pct	
1382830:												
Dwight----------	0-5	Silt loam	CL	A-7-6, A-6	0	0	100	100	95-100	85-100	33-47	12-20
	5-32	Clay, silty clay	CH	A-7-6, A-7	0	0	100	95-100	90-100	85-100	56-74	32-44
	32-42	Clay, silty clay, silty clay loam	CH, CL	A-7-6	0	0	95-100	85-100	85-100	80-100	46-69	25-46
	42-46	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
1382831:												
Labette---------	0-10	Silty clay loam	MH, CH, ML, CL	A-6, A-7-6, A-7-5, A-7	0	0	100	100	96-100	90-100	39-62	17-27
	10-15	Silty clay loam	CH, CL	A-7-6	0	0	100	100	93-100	88-97	42-57	21-28
	15-34	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	100	100	90-100	87-100	47-69	25-40
	34-38	Silty clay, silty clay loam	CL, CH	A-7-6	0	0	91-100	91-100	79-100	76-98	46-63	25-36
	38-42	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
Sogn----------	0-6	Silty clay loam	MH, CL, CH	A-6, A-7-6, A-4, A-7	0	0	85-100	85-100	85-100	70-100	25-55	10-25
	6-10	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
1382833:												
Tully----------	0-14	Gravelly silty clay loam, silt loam	CH, CL, MH	A-7-5, A-7, A-6, A-7-6	0	0	85-100	58-100	52-100	50-98	39-66	17-33
	14-19	Gravelly silty clay loam, silty clay	CH, CL	A-7-6	0	0	85-100	58-100	52-100	50-97	43-59	21-30
	19-49	Gravelly silty clay, silty clay, clay	CL, CH	A-7-6	0	0	85-100	60-100	49-100	47-99	46-67	25-40
	49-60	Gravelly silty clay, silty clay, clay	CL, CH	A-7-6	0	0	85-100	60-100	49-100	47-99	46-68	25-47
1382834:												
Tully----------	0-14	Silty clay loam, silt loam	CL, MH, CH	A-6, A-7-6, A-7-5, A-7	0	0	100	100	89-100	85-98	39-66	17-33
	14-19	Silty clay loam, silty clay	CH, CL	A-7-6	0	0	95-100	95-100	91-100	87-99	43-59	21-31
	19-49	Silty clay, clay	CL, CH	A-7-6	0	0	95-100	95-100	83-100	79-99	46-67	25-40
	49-60	Silty clay, clay	CL, CH	A-7-6	0	0	95-100	95-100	82-100	79-99	46-68	25-47
1382835:												
Tully, eroded---	0-5	Silty clay loam, silt loam	CL, MH, CH	A-6, A-7-6, A-7-5, A-7	0	0	100	100	89-100	85-98	39-66	17-33
	5-10	Silty clay loam, silty clay	CH, CL	A-7-6	0	0	95-100	95-100	91-100	87-99	43-59	21-31
	10-40	Silty clay, clay	CL, CH	A-7-6	0	0	95-100	95-100	83-100	79-99	46-67	25-40
	40-60	Silty clay, clay	CL, CH	A-7-6	0	0	95-100	95-100	82-100	79-99	46-68	25-47

Table 16.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 in	3-10 in	4	10	40	200		
	In				Pct	Pct					Pct	
1382836:												
Reading	0-8	Silt loam	CL	A-7-6, A-6	0	0	100	100	90-100	80-100	33-46	12-19
	8-17	Silt loam, silty clay loam	CL	A-7-6, A-6	0	0	100	100	90-100	80-100	34-46	13-21
	17-24	Silty clay loam	CL	A-7-6, A-6	0	0	100	100	95-100	85-100	39-49	19-25
	24-48	Silty clay loam	CL	A-7-6, A-6	0	0	100	100	95-100	85-100	38-49	19-25
	48-60	Silty clay loam, silty clay	CH, CL	A-6, A-7-6	0	0	100	100	95-100	80-100	40-53	21-30
1382837:												
Reading	0-8	Silt loam	CL	A-7-6, A-6	0	0	100	100	90-100	80-100	33-46	12-19
	8-17	Silt loam, silty clay loam	CL	A-7-6, A-6	0	0	100	100	90-100	80-100	34-46	13-21
	17-24	Silty clay loam	CL	A-7-6, A-6	0	0	100	100	95-100	85-100	39-49	19-25
	24-48	Silty clay loam	CL	A-7-6, A-6	0	0	100	100	95-100	85-100	38-49	19-25
	48-60	Silty clay loam, silty clay	CH, CL	A-6, A-7-6	0	0	100	100	95-100	80-100	40-53	21-30
1382839:												
Martin	0-15	Silty clay loam	CH, CL, MH	A-7, A-7-5, A-7-6	0	0	100	100	95-100	80-100	42-64	19-32
	15-43	Silty clay, silty clay loam	CL, CH	A-7-6, A-7	0	0	100	100	95-100	80-100	47-74	25-44
	43-56	Silty clay, clay	CH	A-7-6	0	0	100	100	95-100	80-100	52-73	29-44
	56-60	Silty clay, clay	CH	A-7-6	0	0	100	100	95-100	80-100	51-72	29-44
1382840:												
Martin, eroded	0-5	Silty clay loam	CH, CL, MH	A-7, A-7-5, A-7-6	0	0	100	100	95-100	80-100	42-64	19-32
	5-33	Silty clay, silty clay loam	CL, CH	A-7-6, A-7	0	0	100	100	95-100	80-100	47-74	25-44
	33-46	Silty clay, clay	CH	A-7-6	0	0	100	100	95-100	80-100	52-73	29-44
	46-60	Silty clay, clay	CH	A-7-6	0	0	100	100	95-100	80-100	51-72	29-44
1382841:												
Martin, eroded	0-5	Silty clay loam	CH, CL, MH	A-7, A-7-5, A-7-6	0	0	100	100	95-100	80-100	42-64	19-32
	5-33	Silty clay, silty clay loam	CL, CH	A-7-6, A-7	0	0	100	100	95-100	80-100	47-74	25-44
	33-46	Silty clay, clay	CH	A-7-6	0	0	100	100	95-100	80-100	52-73	29-44
	46-60	Silty clay, clay	CH	A-7-6	0	0	100	100	95-100	80-100	51-72	29-44
1382845:												
Zaar	0-15	Silty clay	CH	A-7, A-7-6	0	0	100	100	95-100	90-100	50-70	25-40
	15-54	Silty clay, clay	CH, MH	A-7, A-7-6	0	0	100	100	95-100	90-100	50-88	25-48
	54-60	Very parachannery silty clay, clay, silty clay loam	CL, CH	A-6, A-7-6	0	0	100	100	95-100	90-100	40-66	15-40

Table 16.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 in	3-10 in	4	10	40	200		
	In				Pct	Pct					Pct	
1382846:												
Zaar	0-15	Silty clay	CH	A-7, A-7-6	0	0	100	100	95-100	90-100	50-70	25-40
	15-54	Silty clay, clay	CH, MH	A-7, A-7-6	0	0	100	100	95-100	90-100	50-88	25-48
	54-60	Very parachannery silty clay, clay, silty clay loam	CL, CH	A-6, A-7-6	0	0	100	100	95-100	90-100	40-66	15-40
Dwight	0-5	Silt loam	CL	A-7-6, A-6	0	0	100	100	95-100	85-100	33-47	12-20
	5-32	Clay, silty clay	CH	A-7-6, A-7	0	0	100	95-100	90-100	85-100	56-74	32-44
	32-42	Clay, silty clay, silty clay loam	CH, CL	A-7-6	0	0	95-100	85-100	85-100	80-100	46-69	25-46
	42-46	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---

Table 17.—Physical Soil Properties

(Sand, silt, and clay values are shown either as a range or as a representative value. Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
1382809:									
Smolan	0-15	5-15	50-70	27-35	1.30-1.45	0.2-0.6	0.18-0.23	3.0-8.0	2.0-4.0
	15-19	5-15	50-70	27-40	1.30-1.50	0.2-0.6	0.12-0.16	3.0-5.9	1.0-3.0
	19-42	5-15	40-60	35-50	1.30-1.50	0.1-0.2	0.09-0.15	6.0-8.9	0.5-2.0
	42-60	5-15	40-60	30-40	1.30-1.45	0.1-0.2	0.12-0.18	6.0-8.9	0.1-1.0
1382810:									
Chase	0-14	2	68	25-35	1.30-1.45	0.2-0.6	0.15-0.20	4.1-6.7	2.0-3.5
	14-20	2	62	32-40	1.30-1.45	0.2-0.6	0.11-0.18	5.9-7.9	1.0-3.0
	20-46	2	55	35-55	1.35-1.55	0.1-0.2	0.10-0.18	6.7-11.4	0.8-2.0
	46-60	1	57	35-55	1.35-1.55	0.1-0.2	0.11-0.18	6.7-11.4	0.5-2.0
1382811:									
Ivan	0-20	6	68	16-27	1.30-1.45	0.6-2.0	0.16-0.24	0.0-4.5	2.0-4.0
	20-35	4	67	18-35	1.30-1.55	0.6-2.0	0.15-0.22	3.0-5.9	1.0-3.0
	35-60	7	68	18-35	1.35-1.55	0.6-2.0	0.15-0.22	0.0-5.9	0.5-1.5
1382812:									
Ivan	0-17	1-10	50-75	16-27	1.30-1.45	0.6-2.0	0.16-0.22	1.5-4.5	2.0-4.0
	17-32	1-10	45-75	18-35	1.35-1.55	0.6-2.0	0.16-0.22	0.5-5.9	0.8-3.0
	32-60	1-10	45-75	18-35	1.35-1.55	0.6-2.0	0.16-0.22	0.5-5.9	0.8-3.0
1382813:									
Kahola	0-17	1-20	50-75	18-27	1.35-1.40	0.6-2.0	0.18-0.24	3.0-5.9	2.0-4.0
	17-25	1-35	40-60	15-35	1.35-1.40	0.6-2.0	0.17-0.22	3.0-5.9	1.0-3.0
	25-35	1-35	40-60	15-35	1.35-1.40	0.6-2.0	0.17-0.22	3.0-5.9	0.8-2.0
	35-60	1-35	40-60	15-35	1.35-1.40	0.6-2.0	0.17-0.22	3.0-5.9	0.5-1.0
1382816:									
Clime	0-9	5-15	40-55	40-50	1.00-1.45	0.1-0.2	0.08-0.14	3.0-5.9	2.0-6.0
	9-26	5-15	30-50	35-60	1.20-1.50	0.1-0.2	0.08-0.16	1.5-8.9	1.0-3.0
	26-33	4-15	30-50	35-60	1.30-1.50	0.1-0.2	0.08-0.17	6.0-8.9	0.5-2.0
	33-37	---	---	---	---	0.0-0.2	---	---	---
Sogn	0-7	1-15	50-70	27-35	1.15-1.20	0.6-2.0	0.14-0.18	3.0-5.9	1.0-3.0
	7-11	---	---	---	---	0.0-0.2	---	---	---
1382818:									
Dwight	0-5	1-10	60-75	18-27	1.10-1.35	0.6-2.0	0.21-0.24	3.0-5.9	2.0-4.0
	5-32	1-15	25-50	45-60	1.30-1.40	0.0-0.1	0.10-0.14	6.0-9.0	1.0-3.0
	32-42	1-10	35-60	35-55	1.20-1.40	0.1-0.2	0.10-0.15	6.0-10.6	0.5-1.0
	42-46	---	---	---	---	0.0-0.2	---	---	---

Table 17.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
1382821:									
Florence--------	0-3	1-20	50-75	18-27	1.25-1.35	0.6-2.0	0.05-0.18	3.0-5.9	4.0-8.0
	3-13	1-15	40-70	18-27	1.35-1.55	0.2-0.6	0.01-0.07	0.6-8.9	2.0-6.0
	13-20	1-20	15-60	27-40	1.35-1.55	0.2-0.6	0.01-0.07	1.0-8.9	0.7-2.0
	20-42	1-15	15-40	50-80	1.35-1.55	0.2-0.6	0.01-0.07	1.5-8.9	0.3-1.5
	42-46	---	---	---	---	0.0-0.2	---	---	---
Labette---------	0-10	1-12	50-70	25-38	1.35-1.45	0.2-0.6	0.15-0.20	3.7-8.9	2.0-6.0
	10-15	1-12	50-70	30-39	1.24-1.45	0.2-0.6	0.07-0.15	4.2-8.9	1.0-3.5
	15-34	1-12	40-60	35-55	1.40-1.50	0.1-0.2	0.06-0.14	6.0-13.1	1.0-2.0
	34-38	1-12	40-60	35-50	1.05-1.50	0.1-0.2	0.12-0.19	6.0-8.9	0.5-1.5
	38-42	---	---	---	---	0.0-0.2	---	---	---
1382822:									
Florence--------	0-3	1-20	50-75	18-27	1.25-1.35	0.6-2.0	0.05-0.18	3.0-5.9	4.0-8.0
	3-13	1-15	40-70	18-27	1.35-1.55	0.2-0.6	0.01-0.07	0.6-8.9	2.0-6.0
	13-20	1-20	15-60	27-40	1.35-1.55	0.2-0.6	0.01-0.07	1.0-8.9	0.7-2.0
	20-42	1-15	15-40	50-80	1.35-1.55	0.2-0.6	0.01-0.07	1.5-8.9	0.3-1.5
	42-46	---	---	---	---	0.0-0.2	---	---	---
Matfield--------	0-12	5-15	50-75	18-27	1.25-1.35	0.6-5.9	0.04-0.10	0.0-2.9	4.0-7.0
	12-22	5-15	50-75	18-27	1.35-1.55	0.6-5.9	0.04-0.10	0.0-2.9	2.0-6.0
	22-46	5-15	20-75	18-27	1.35-1.45	0.0-0.1	0.03-0.09	0.8-5.9	0.3-2.0
	46-60	5-15	20-45	50-80	1.35-1.45	0.0-0.1	0.03-0.09	1.9-5.9	0.3-1.0
1382823:									
Irwin-----------	0-11	3-10	40-65	28-35	1.35-1.45	0.2-0.6	0.21-0.23	3.0-5.9	2.5-5.0
	11-38	2-10	35-55	40-60	1.21-1.50	0.0-0.1	0.10-0.13	6.0-13.0	1.0-3.0
	38-53	2-10	35-55	40-60	1.20-1.50	0.0-0.1	0.10-0.13	6.0-13.0	0.5-1.5
	53-60	2-8	35-55	35-55	1.15-1.50	0.1-0.2	0.09-0.19	5.5-8.9	0.2-0.5
1382824:									
Irwin, eroded---	0-5	3-10	40-65	28-35	1.35-1.45	0.2-0.6	0.21-0.23	3.0-5.9	1.0-3.0
	5-38	2-10	35-55	40-60	1.21-1.50	0.0-0.1	0.10-0.13	6.0-13.0	0.8-2.0
	38-53	2-10	35-55	40-60	1.20-1.50	0.0-0.1	0.10-0.13	6.0-13.0	0.5-1.5
	53-60	2-8	35-55	35-55	1.15-1.50	0.1-0.2	0.09-0.19	5.5-8.9	0.2-0.5
1382825:									
Irwin-----------	0-11	3-10	40-65	28-35	1.35-1.45	0.2-0.6	0.21-0.23	3.0-5.9	2.5-5.0
	11-38	2-10	35-55	40-60	1.21-1.50	0.0-0.1	0.10-0.13	6.0-13.0	1.0-3.0
	38-53	2-10	35-55	40-60	1.20-1.50	0.0-0.1	0.10-0.13	6.0-13.0	0.5-1.5
	53-60	2-8	35-55	35-55	1.15-1.50	0.1-0.2	0.09-0.19	5.5-8.9	0.2-0.5
1382826:									
Irwin, eroded---	0-4	3-10	40-65	30-42	1.35-1.45	0.2-0.6	0.16-0.20	6.0-8.9	2.0-3.0
	4-53	2-10	35-55	40-60	1.20-1.50	0.0-0.1	0.10-0.16	6.0-12.0	0.8-2.0
	53-60	2-8	35-55	38-55	1.15-1.50	0.1-0.2	0.09-0.20	5.7-10.4	0.2-1.5

Table 17.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
1382827:									
Labette	0-10	1-12	50-70	25-38	1.35-1.45	0.2-0.6	0.15-0.20	3.7-8.9	2.0-6.0
	10-15	1-12	50-70	30-39	1.24-1.45	0.2-0.6	0.07-0.15	4.2-8.9	1.0-3.5
	15-34	1-12	40-60	35-55	1.40-1.50	0.1-0.2	0.06-0.14	6.0-13.1	1.0-2.0
	34-38	1-12	40-60	35-50	1.05-1.50	0.1-0.2	0.12-0.19	6.0-8.9	0.5-1.5
	38-42	---	---	---	---	0.0-0.2	---	---	---
1382828:									
Labette	0-10	1-12	50-70	25-38	1.35-1.45	0.2-0.6	0.15-0.20	3.7-8.9	2.0-6.0
	10-15	1-12	50-70	30-39	1.24-1.45	0.2-0.6	0.07-0.15	4.2-8.9	1.0-3.5
	15-34	1-12	40-60	35-55	1.40-1.50	0.1-0.2	0.06-0.14	6.0-13.1	1.0-2.0
	34-38	1-12	40-60	35-50	1.05-1.50	0.1-0.2	0.12-0.19	6.0-8.9	0.5-1.5
	38-42	---	---	---	---	0.0-0.2	---	---	---
1382830:									
Labette	0-10	1-12	50-70	25-38	1.35-1.45	0.2-0.6	0.15-0.20	3.7-8.9	2.0-6.0
	10-15	1-12	50-70	30-39	1.24-1.45	0.2-0.6	0.07-0.15	4.2-8.9	1.0-3.5
	15-34	1-12	40-60	35-55	1.40-1.50	0.1-0.2	0.06-0.14	6.0-13.1	1.0-2.0
	34-38	1-12	40-60	35-50	1.05-1.50	0.1-0.2	0.12-0.19	6.0-8.9	0.5-1.5
	38-42	---	---	---	---	0.0-0.2	---	---	---
Dwight	0-5	1-10	60-75	18-27	1.10-1.35	0.6-2.0	0.21-0.24	3.0-5.9	2.0-4.0
	5-32	1-15	25-50	45-60	1.30-1.40	0.0-0.1	0.10-0.14	6.0-9.0	1.0-3.0
	32-42	1-10	35-60	35-55	1.20-1.40	0.1-0.2	0.10-0.15	6.0-10.6	0.5-1.0
	42-46	---	---	---	---	0.0-0.2	---	---	---
1382831:									
Labette	0-10	1-12	50-70	25-38	1.35-1.45	0.2-0.6	0.15-0.20	3.7-8.9	2.0-6.0
	10-15	1-12	50-70	30-39	1.24-1.45	0.2-0.6	0.07-0.15	4.2-8.9	1.0-3.5
	15-34	1-12	40-60	35-55	1.40-1.50	0.1-0.2	0.06-0.14	6.0-13.1	1.0-2.0
	34-38	1-12	40-60	35-50	1.05-1.50	0.1-0.2	0.12-0.19	6.0-8.9	0.5-1.5
	38-42	---	---	---	---	0.0-0.2	---	---	---
Sogn	0-6	1-15	50-70	27-35	1.15-1.20	0.6-2.0	0.14-0.18	3.0-5.9	1.0-3.0
	6-10	---	---	---	---	0.0-0.2	---	---	---
1382833:									
Tully	0-14	1-10	50-70	25-38	1.30-1.45	0.2-2.0	0.10-0.17	3.0-5.9	2.0-6.0
	14-19	1-10	50-70	30-42	1.30-1.45	0.2-2.0	0.10-0.16	6.0-8.9	1.0-3.0
	19-49	1-10	35-60	35-55	1.40-1.50	0.1-0.2	0.05-0.12	6.0-9.7	0.5-1.5
	49-60	1-10	35-60	35-55	1.40-1.50	0.1-0.2	0.04-0.12	6.0-8.9	0.3-1.0
1382834:									
Tully	0-14	1-10	50-70	25-38	1.30-1.45	0.2-2.0	0.10-0.17	3.0-5.9	2.0-6.0
	14-19	1-10	50-70	30-42	1.30-1.45	0.2-2.0	0.10-0.16	6.0-9.8	1.0-3.0
	19-49	1-10	35-60	35-55	1.40-1.50	0.1-0.2	0.06-0.12	6.0-9.7	0.5-1.5
	49-60	1-10	35-60	35-55	1.40-1.50	0.1-0.2	0.05-0.12	6.0-8.9	0.3-1.0

Table 17.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
1382835									
Tully, eroded---	0-5	1-10	50-70	25-38	1.30-1.45	0.2-2.0	0.10-0.17	3.0-5.9	1.0-3.5
	5-10	1-10	50-70	30-42	1.30-1.45	0.2-2.0	0.10-0.16	6.0-9.8	0.8-3.0
	10-40	1-10	35-60	35-55	1.40-1.50	0.1-0.2	0.06-0.12	6.0-9.7	0.5-1.5
	40-60	1-10	35-60	35-55	1.40-1.50	0.1-0.2	0.05-0.12	6.0-8.9	0.3-1.0
1382836:									
Reading---------	0-8	8	67	18-27	1.35-1.40	0.6-2.0	0.18-0.24	2.2-4.9	2.0-4.0
	8-17	6	64	20-30	1.35-1.42	0.6-2.0	0.12-0.20	2.2-4.9	2.0-3.0
	17-24	6	61	27-35	1.40-1.50	0.2-2.0	0.12-0.20	3.0-5.9	1.0-2.0
	24-48	7	63	27-35	1.40-1.50	0.2-2.0	0.12-0.20	3.0-5.9	0.5-2.0
	48-60	9	56	30-42	1.35-1.50	0.2-2.0	0.12-0.20	3.0-5.9	0.5-1.0
1382837:									
Reading---------	0-8	8	67	18-27	1.35-1.40	0.6-2.0	0.18-0.24	2.2-4.9	2.0-4.0
	8-17	6	64	20-30	1.35-1.42	0.6-2.0	0.12-0.20	2.2-4.9	2.0-3.0
	17-24	6	61	27-35	1.40-1.50	0.2-2.0	0.12-0.20	3.0-5.9	1.0-2.0
	24-48	7	63	27-35	1.40-1.50	0.2-2.0	0.12-0.20	3.0-5.9	0.5-2.0
	48-60	9	56	30-42	1.35-1.50	0.2-2.0	0.12-0.20	3.0-5.9	0.5-1.0
1382839:									
Martin----------	0-15	11	49	27-40	1.10-1.40	0.2-0.6	0.14-0.18	4.6-7.9	2.0-5.0
	15-43	7	41	35-60	1.40-1.50	0.1-0.2	0.08-0.12	6.0-8.9	1.0-3.0
	43-56	8	41	40-60	1.35-1.50	0.1-0.2	0.08-0.12	7.9-10.4	0.5-2.0
	56-60	12	36	40-60	1.40-1.50	0.1-0.2	0.08-0.12	7.0-10.4	0.1-1.5
1382840:									
Martin, eroded--	0-5	11	49	27-40	1.10-1.40	0.2-0.6	0.14-0.18	4.6-7.9	1.5-3.5
	5-33	7	41	35-60	1.40-1.50	0.1-0.2	0.08-0.12	6.0-8.9	1.0-3.0
	33-46	8	41	40-60	1.35-1.50	0.1-0.2	0.08-0.12	7.9-10.4	0.5-2.0
	46-60	12	36	40-60	1.40-1.50	0.1-0.2	0.08-0.12	7.0-10.4	0.1-1.5
1382841:									
Martin, eroded--	0-5	11	49	27-40	1.10-1.40	0.2-0.6	0.14-0.18	4.6-7.9	1.5-3.5
	5-33	7	41	35-60	1.40-1.50	0.1-0.2	0.08-0.12	6.0-8.9	1.0-3.0
	33-46	8	41	40-60	1.35-1.50	0.1-0.2	0.08-0.12	7.9-10.4	0.5-2.0
	46-60	12	36	40-60	1.40-1.50	0.1-0.2	0.08-0.12	7.0-10.4	0.1-1.5
1382845:									
Zaar----------	0-15	3	54	40-60	1.20-1.30	0.0-0.1	0.12-0.20	6.0-13.0	2.0-4.0
	15-54	2	42	40-60	1.10-1.50	0.0-0.1	0.11-0.18	6.0-18.5	1.0-3.0
	54-60	6	43	35-60	1.20-1.50	0.0-0.1	0.06-0.12	6.0-13.5	0.5-2.0
1382846:									
Zaar----------	0-15	3	54	40-60	1.20-1.30	0.0-0.1	0.12-0.20	6.0-13.0	2.0-4.0
	15-54	2	42	40-60	1.10-1.50	0.0-0.1	0.11-0.18	6.0-18.5	1.0-3.0
	54-60	6	43	35-60	1.20-1.50	0.0-0.1	0.06-0.12	6.0-13.5	0.5-2.0

Table 17.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct
1382846:									
Dwight----------	0-5	1-10	60-75	18-27	1.10-1.35	0.6-2.0	0.21-0.24	3.0-5.9	2.0-4.0
	5-32	1-15	25-50	45-60	1.30-1.40	0.0-0.1	0.10-0.14	6.0-9.0	1.0-3.0
	32-42	1-10	35-60	35-55	1.20-1.40	0.1-0.2	0.10-0.15	6.0-10.6	0.5-1.0
	42-46	---	---	---	---	0.0-0.2	---	---	---

Table 18.—Erosion Properties

(Entries under "Erosion factors" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer)

Map unit symbol and soil name	Depth (inches)	Erosion factors			Wind erodibility group	Wind erodibility index
		Kw	Kf	T		
1382809:						
Smolan	0-15	.37	.37	5	7	38
	15-19	.37	.37			
	19-42	.37	.37			
	42-60	.37	.37			
1382810:						
Chase	0-14	.37	.37	5	7	38
	14-20	.37	.37			
	20-46	.28	.28			
	46-60	.28	.28			
1382811:						
Ivan	0-20	.32	.32	5	4L	86
	20-35	.32	.32			
	35-60	.32	.32			
1382812:						
Ivan	0-17	.32	.32	5	4L	86
	17-32	.32	.32			
	32-60	.32	.32			
1382813:						
Kahola	0-17	.32	.32	5	6	48
	17-25	.32	.32			
	25-35	.32	.32			
	35-60	.32	.32			
1382816:						
Clime	0-9	.28	.28	3	4	86
	9-26	.28	.28			
	26-33	.32	.32			
	33-37	---	---			
Sogn	0-7	.32	.32	1	4L	86
	7-11	---	---			
1382818:						
Dwight	0-5	.43	.43	2	6	48
	5-32	.32	.32			
	32-42	.32	.32			
	42-46	---	---			
1382821:						
Florence	0-3	.24	.32	3	8	0
	3-13	.24	.64			
	13-20	.24	.64			
	20-42	.24	.64			
	42-46	---	---			
Labette	0-10	.37	.37	2	7	38
	10-15	.37	.37			
	15-34	.37	.64			
	34-38	.37	.64			
	38-42	---	---			

Table 18.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (inches)	Erosion factors			Wind erodibility group	Wind erodibility index
		Kw	Kf	T		
1382822:						
Florence	0-3	.24	.32	3	8	0
	3-13	.24	.64			
	13-20	.24	.64			
	20-42	.24	.64			
	42-46	---	---			
Matfield	0-12	.24	.64	4	8	0
	12-22	.24	.64			
	22-46	.24	.64			
	46-60	.24	.64			
1382823:						
Irwin	0-11	.37	.37	5	7	38
	11-38	.28	.28			
	38-53	.28	.28			
	53-60	.32	.32			
1382824:						
Irwin, eroded	0-5	.37	.37	5	7	38
	5-38	.28	.28			
	38-53	.28	.28			
	53-60	.32	.32			
1382825:						
Irwin	0-11	.37	.37	5	7	38
	11-38	.28	.28			
	38-53	.28	.28			
	53-60	.32	.32			
1382826:						
Irwin, eroded	0-4	.37	.37	5	7	38
	4-53	.28	.28			
	53-60	.32	.32			
1382827:						
Labette	0-10	.37	.37	2	7	38
	10-15	.37	.37			
	15-34	.37	.64			
	34-38	.37	.64			
	38-42	---	---			
1382828:						
Labette	0-10	.37	.37	2	7	38
	10-15	.37	.37			
	15-34	.37	.64			
	34-38	.37	.64			
	38-42	---	---			
1382830:						
Labette	0-10	.37	.37	2	7	38
	10-15	.37	.37			
	15-34	.37	.64			
	34-38	.37	.64			
	38-42	---	---			
Dwight	0-5	.43	.43	2	6	48
	5-32	.32	.32			
	32-42	.32	.32			
	42-46	---	---			

Table 18.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (inches)	Erosion factors			Wind erodibility group	Wind erodibility index
		Kw	Kf	T		
1382831:						
Labette	0-10	.37	.37	2	7	38
	10-15	.37	.37			
	15-34	.37	.64			
	34-38	.37	.64			
	38-42	---	---			
Sogn	0-6	.32	.32	1	4L	86
	6-10	---	---			
1382833:						
Tully	0-14	.24	.32	5	8	0
	14-19	.28	.37			
	19-49	.37	.37			
	49-60	.37	.37			
1382834:						
Tully	0-14	.32	.32	5	7	38
	14-19	.28	.37			
	19-49	.37	.37			
	49-60	.37	.37			
1382835:						
Tully, eroded	0-5	.32	.32	5	7	38
	5-10	.28	.37			
	10-40	.37	.37			
	40-60	.37	.37			
1382836:						
Reading	0-8	.32	.32	5	6	48
	8-17	.32	.32			
	17-24	.43	.43			
	24-48	.43	.43			
	48-60	.43	.43			
1382837:						
Reading	0-8	.32	.32	5	6	48
	8-17	.32	.32			
	17-24	.43	.43			
	24-48	.43	.43			
	48-60	.43	.43			
1382839:						
Martin	0-15	.37	.37	5	7	38
	15-43	.37	.37			
	43-56	.37	.37			
	56-60	.37	.37			
1382840:						
Martin, eroded	0-5	.37	.37	5	4	86
	5-33	.37	.37			
	33-46	.37	.37			
	46-60	.37	.37			
1382841:						
Martin, eroded	0-5	.37	.37	5	4	86
	5-33	.37	.37			
	33-46	.37	.37			
	46-60	.37	.37			
Gullied land.						

Table 18.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (inches)	Erosion factors			Wind erodibility group	Wind erodibility index
		Kw	Kf	T		
1382845:						
Zaar	0-15	.28	.28	5	4	86
	15-54	.28	.28			
	54-60	.28	.28			
1382846:						
Zaar	0-15	.28	.28	5	4	86
	15-54	.28	.28			
	54-60	.28	.28			
Dwight	0-5	.43	.43	2	6	48
	5-32	.32	.32			
	32-42	.32	.32			
	42-46	---	---			
1382849.						
Borrow pits						
1382850.						
Gravel pits and quarries						
1382851.						
Miscellaneous water						
1382852.						
Water						

Table 19.—Total Soil Carbon

(This table displays soil organic carbon (SOC) and soil inorganic carbon (SIC) in kilograms per square meter to a depth of 2 meters or to the representative top depth of any kind of bedrock or any cemented soil horizon. SOC and SIC are reported on a volumetric whole soil basis, corrected for representative rock fragments indicated in the database. SOC is converted from horizon soil organic matter of the fraction of the soil less than 2 mm in diameter. If soil organic matter indicated in the database is NULL, SOC is assumed to be zero. SIC is converted from horizon calcium carbonate content fraction of the soil less than 2 mm in diameter. If horizon calcium carbonate indicated in the database is NULL, SIC is assumed to be zero. A weighted average of all horizons is used in the calculations. Only major components of a map unit are displayed in this table)

Map unit symbol, component name, and component percent	SOC	SIC
	kg/m^2	kg/m^2
1382809:		
Smolan (90%)	18	0
1382810:		
Chase (90%)	20	0
1382811:		
Ivan (80%)	22	10
1382812:		
Ivan (85%)	22	13
1382813:		
Kahola (85%)	19	4
1382816:		
Clime (67%)	12	22
Sogn (30%)	2	0
1382818:		
Dwight (85%)	15	0
1382821:		
Florence (47%)	9	0
Labette (34%)	17	0
1382822:		
Florence (70%)	12	0
Matfield (25%)	15	0
1382823:		
Irwin (85%)	20	0
1382824:		
Irwin, eroded (95%)	13	0
1382825:		
Irwin (90%)	20	0
1382826:		
Irwin, eroded (90%)	16	0

Table 19.—Total Soil Carbon—Continued

Map unit symbol, component name, and component percent	SOC	SIC
	kg/m^2	kg/m^2
1382827:		
Labette (85%)	17	0
1382828:		
Labette (85%)	17	0
1382830:		
Labette (50%)	17	0
Dwight (41%)	15	0
1382831:		
Labette (47%)	17	0
Sogn (38%)	2	0
1382833:		
Tully (70%)	16	0
1382834:		
Tully (85%)	18	0
1382835:		
Tully, eroded (85%)	13	0
1382836:		
Reading (85%)	22	0
1382837:		
Reading (90%)	22	0
1382839:		
Martin (85%)	24	0
1382840:		
Martin, eroded (85%)	18	1
1382841:		
Martin, eroded (80%)	18	1
Gullied land (20%)	0	0
1382845:		
Zaar (85%)	23	1
1382846:		
Zaar (55%)	23	1
Dwight (45%)	15	0
1382849:		
Borrow pits (100%)	0	0
1382850:		
Gravel pits and quarries (100%)	0	0
1382851:		
Miscellaneous water (100%)	0	0
1382852:		
Water (100%)	0	0

Table 20.—Chemical Soil Properties

(Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Salinity	Sodium adsorption ratio
	In	meq/100 g	pH	Pct	mmhos/cm	
1382809:						
Smolan	0-15	23.0-36.1	5.6-7.3	0	0	0
	15-19	18.3-36.8	5.6-7.3	0	0	0
	19-42	18.2-39.0	5.6-7.8	0	0	0
	42-60	9.4-41.0	5.6-7.8	0-1	0	0
1382810:						
Chase	0-14	21.5-34.5	5.6-7.3	0	0	0
	14-20	21.1-36.8	5.6-7.3	0	0	0
	20-46	20.8-42.4	5.6-7.8	0	0	0
	46-60	22.8-48.4	5.6-7.8	0	0	0
1382811:						
Ivan	0-20	7.0-25.0	7.4-8.4	2-7	0	0
	20-35	7.0-30.0	7.9-8.4	1-10	0	0
	35-60	7.0-21.0	7.9-8.4	2-15	0	0
1382812:						
Ivan	0-17	7.0-22.0	7.4-8.4	0-10	0	0
	17-32	7.0-21.0	7.9-8.4	1-10	0	0
	32-60	7.0-21.0	7.9-8.4	1-10	0	0
1382813:						
Kahola	0-17	15.9-23.6	6.1-7.8	0	0	0
	17-25	12.7-28.0	7.4-8.4	0	0	0
	25-35	12.7-28.0	7.4-8.4	1-5	0	0
	35-60	12.7-28.0	7.4-8.4	1-5	0	0
1382816:						
Clime	0-9	16.0-36.0	6.6-8.4	5-10	0	0
	9-26	14.0-39.0	7.4-8.4	5-30	0	0
	26-33	14.0-32.0	7.4-8.4	10-35	0	0
	33-37	---	---	---	---	---
Sogn	0-7	11.0-23.0	6.1-8.4	0-4	0	0
	7-11	---	---	---	---	---
1382818:						
Dwight	0-5	11.0-24.0	5.6-7.3	0	0.0-1.0	0-4
	5-32	20.0-42.0	6.1-8.4	0	0.0-2.0	0-13
	32-42	15.0-35.0	6.6-8.4	0	0.0-2.0	0-13
	42-46	---	---	---	---	---
1382821:						
Florence	0-3	18.0-36.3	5.6-7.3	0	0	0
	3-13	16.2-33.0	5.6-7.3	0	0	0
	13-20	16.2-32.2	6.1-7.8	0	0	0
	20-42	20.9-53.2	6.1-7.8	0	0	0
	42-46	---	---	---	---	---
Labette	0-10	20.5-32.3	5.6-6.5	0	0	0
	10-15	21.9-31.0	5.6-6.5	0	0	0
	15-34	24.7-38.2	6.1-7.8	0	0	0
	34-38	22.9-34.3	6.6-8.4	0	0	0
	38-42	---	---	---	---	---

Table 20.—Chemical Soil Properties—Continued

Map unit symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Salinity	Sodium adsorption ratio
	In	meq/100 g	pH	Pct	mmhos/cm	
1382822:						
Florence	0-3	18.0-36.3	5.6-7.3	0	0	0
	3-13	16.2-33.0	5.6-7.3	0	0	0
	13-20	16.2-32.2	6.1-7.8	0	0	0
	20-42	20.9-53.2	6.1-7.8	0	0	0
	42-46	---	---	---	---	---
Matfield	0-12	16.2-34.7	5.6-7.3	0	0	0
	12-22	15.2-33.0	5.6-7.3	0	0	0
	22-46	8.7-23.0	6.1-7.3	0	0	0
	46-60	20.9-46.5	6.1-7.3	0	0	0
1382823:						
Irwin	0-11	12.0-28.0	5.6-7.3	0	0	0
	11-38	16.0-40.0	5.6-8.4	0	0	0
	38-53	16.0-40.0	5.6-8.4	0	0	0
	53-60	14.0-40.0	6.6-8.4	0	0	0-13
1382824:						
Irwin, eroded	0-5	12.0-28.0	5.6-7.3	0	0	0
	5-38	16.0-40.0	5.6-8.4	0	0	0
	38-53	16.0-40.0	5.6-8.4	0	0	0
	53-60	14.0-40.0	6.6-8.4	0	0	0-13
1382825:						
Irwin	0-11	12.0-28.0	5.6-7.3	0	0	0
	11-38	16.0-40.0	5.6-8.4	0	0	0
	38-53	16.0-40.0	5.6-8.4	0	0	0
	53-60	14.0-40.0	6.6-8.4	0	0	0-13
1382826:						
Irwin, eroded	0-4	23.7-32.3	5.6-7.3	0	0	0
	4-53	26.6-40.9	5.6-8.4	0	0	0
	53-60	24.9-35.2	6.6-8.4	0	0	0
1382827:						
Labette	0-10	20.5-32.3	5.6-6.5	0	0	0
	10-15	21.9-31.0	5.6-6.5	0	0	0
	15-34	24.7-38.2	6.1-7.8	0	0	0
	34-38	22.9-34.3	6.6-8.4	0	0	0
	38-42	---	---	---	---	---
1382828:						
Labette	0-10	20.5-32.3	5.6-6.5	0	0	0
	10-15	21.9-31.0	5.6-6.5	0	0	0
	15-34	24.7-38.2	6.1-7.8	0	0	0
	34-38	22.9-34.3	6.6-8.4	0	0	0
	38-42	---	---	---	---	---
1382830:						
Labette	0-10	20.5-32.3	5.6-6.5	0	0	0
	10-15	21.9-31.0	5.6-6.5	0	0	0
	15-34	24.7-38.2	6.1-7.8	0	0	0
	34-38	22.9-34.3	6.6-8.4	0	0	0
	38-42	---	---	---	---	---

Table 20.—Chemical Soil Properties—Continued

Map unit symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Salinity	Sodium adsorption ratio
	In	meq/100 g	pH	Pct	mmhos/cm	
1382830:						
Dwight	0-5	11.0-24.0	5.6-7.3	0	0.0-1.0	0-4
	5-32	20.0-42.0	6.1-8.4	0	0.0-2.0	0-13
	32-42	15.0-35.0	6.6-8.4	0	0.0-2.0	0-13
	42-46	---	---	---	---	---
1382831:						
Labette	0-10	20.5-32.3	5.6-6.5	0	0	0
	10-15	21.9-31.0	5.6-6.5	0	0	0
	15-34	24.7-38.2	6.1-7.8	0	0	0
	34-38	22.9-34.3	6.6-8.4	0	0	0
	38-42	---	---	---	---	---
Sogn	0-6	11.0-23.0	6.1-8.4	0-4	0	0
	6-10	---	---	---	---	---
1382833:						
Tully	0-14	20.5-34.0	5.6-7.3	0	0	0
	14-19	21.9-32.3	5.6-7.3	0	0	0
	19-49	22.9-36.9	5.6-7.8	0	0	0
	49-60	21.6-38.0	5.6-7.8	0-1	0	0
1382834:						
Tully	0-14	20.5-34.0	5.6-7.3	0	0	0
	14-19	21.9-32.3	5.6-7.3	0	0	0
	19-49	22.9-36.9	5.6-7.8	0	0	0
	49-60	21.6-38.0	5.6-7.8	0-1	0	0
1382835:						
Tully, eroded	0-5	20.5-34.0	5.6-7.3	0	0	0
	5-10	21.9-32.3	5.6-7.3	0	0	0
	10-40	22.9-36.9	5.6-7.8	0	0	0
	40-60	21.6-38.0	5.6-7.8	0-1	0	0
1382836:						
Reading	0-8	15.9-23.6	5.6-6.5	0	0	0
	8-17	17.2-24.8	5.6-6.5	0	0	0
	17-24	20.2-26.8	5.6-6.5	0	0	0
	24-48	18.7-26.8	5.6-6.5	0	0	0
	48-60	20.3-28.5	6.1-8.4	0	0	0
1382837:						
Reading	0-8	15.9-23.6	5.6-6.5	0	0	0
	8-17	17.2-24.8	5.6-6.5	0	0	0
	17-24	20.2-26.8	5.6-6.5	0	0	0
	24-48	18.7-26.8	5.6-6.5	0	0	0
	48-60	20.3-28.5	6.1-8.4	0	0	0
1382839:						
Martin	0-15	23.0-46.0	5.6-6.5	0	0	0
	15-43	22.8-52.2	5.6-6.5	0	0	0
	43-56	20.4-45.6	5.6-7.8	0	0	0
	56-60	12.0-41.5	5.6-7.8	0-2	0	0
1382840:						
Martin, eroded	0-5	23.0-46.0	5.6-6.5	0	0	0
	5-33	22.8-52.2	5.6-6.5	0	0	0
	33-46	20.4-45.6	5.6-7.8	0	0	0
	46-60	12.0-41.5	5.6-7.8	0-2	0	0

Table 20.—Chemical Soil Properties—Continued

Map unit symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Salinity	Sodium adsorption ratio
	In	meq/100 g	pH	Pct	mmhos/cm	
1382841:						
Martin, eroded	0-5	23.0-46.0	5.6-6.5	0	0	0
	5-33	22.8-52.2	5.6-6.5	0	0	0
	33-46	20.4-45.6	5.6-7.8	0	0	0
	46-60	12.0-41.5	5.6-7.8	0-2	0	0
1382845:						
Zaar	0-15	16.0-41.0	5.6-6.5	0	0	0
	15-54	16.0-48.0	6.1-8.4	0-2	0	0
	54-60	14.0-43.0	6.6-8.4	0-8	0	0
1382846:						
Zaar	0-15	16.0-41.0	5.6-6.5	0	0	0
	15-54	16.0-48.0	6.1-8.4	0-2	0	0
	54-60	14.0-43.0	6.6-8.4	0-8	0	0
Dwight	0-5	11.0-24.0	5.6-7.3	0	0.0-1.0	0-4
	5-32	20.0-42.0	6.1-8.4	0	0.0-2.0	0-13
	32-42	15.0-35.0	6.6-8.4	0	0.0-2.0	0-13
	42-46	---	---	---	---	---

Table 21.—Water Features

(See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map unit symbol and soil name	Hydrologic group	Months	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
1382809:									
Smolan	C								
		Jan-Dec	---	---	---	---	None	---	None
1382810:									
Chase	C								
		January	---	---	---	---	None	Very brief	Occasional
		February	3.0	>6.0	---	---	None	Very brief	Occasional
		March	3.0	>6.0	---	---	None	Very brief	Occasional
		April	3.0	>6.0	---	---	None	Very brief	Occasional
		May	3.0	>6.0	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
		November	---	---	---	---	None	Very brief	Occasional
		December	---	---	---	---	None	Very brief	Occasional
1382811:									
Ivan	B								
		January	---	---	---	---	None	Very brief	Frequent
		February	---	---	---	---	None	Very brief	Frequent
		March	---	---	---	---	None	Very brief	Frequent
		April	---	---	---	---	None	Very brief	Frequent
		May	---	---	---	---	None	Very brief	Frequent
		June	---	---	---	---	None	Very brief	Frequent
		July	---	---	---	---	None	Very brief	Frequent
		August	---	---	---	---	None	Very brief	Frequent
		September	---	---	---	---	None	Very brief	Frequent
		October	---	---	---	---	None	Very brief	Frequent
		November	---	---	---	---	None	Very brief	Frequent
		December	---	---	---	---	None	Very brief	Frequent

Table 21.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
1382812:									
Ivan	B								
		January	---	---	---	---	None	Very brief	Occasional
		February	---	---	---	---	None	Very brief	Occasional
		March	---	---	---	---	None	Very brief	Occasional
		April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
		November	---	---	---	---	None	Very brief	Occasional
		December	---	---	---	---	None	Very brief	Occasional
1382813:									
Kahola	B								
		January	---	---	---	---	None	Very brief	Occasional
		February	---	---	---	---	None	Very brief	Occasional
		March	---	---	---	---	None	Very brief	Occasional
		April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
		November	---	---	---	---	None	Very brief	Occasional
		December	---	---	---	---	None	Very brief	Occasional
1382816:									
Clime	C								
		Jan-Dec	---	---	---	---	None	---	None
Sogn	D								
		Jan-Dec	---	---	---	---	None	---	None
1382818:									
Dwight	D								
		Jan-Dec	---	---	---	---	None	---	None
1382821:									
Florence	C								
		Jan-Dec	---	---	---	---	None	---	None
Labette	C								
		Jan-Dec	---	---	---	---	None	---	None

Table 21.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
1382822:									
Florence	C								
		Jan-Dec	---	---	---	---	None	---	None
Matfield	C								
		Jan-Dec	---	---	---	---	None	---	None
1382823:									
Irwin	D								
		Jan-Dec	---	---	---	---	None	---	None
1382824:									
Irwin, eroded	D								
		Jan-Dec	---	---	---	---	None	---	None
1382825:									
Irwin	D								
		Jan-Dec	---	---	---	---	None	---	None
1382826:									
Irwin, eroded	D								
		Jan-Dec	---	---	---	---	None	---	None
1382827:									
Labette	C								
		Jan-Dec	---	---	---	---	None	---	None
1382828:									
Labette	C								
		Jan-Dec	---	---	---	---	None	---	None
1382830:									
Labette	C								
		Jan-Dec	---	---	---	---	None	---	None
Dwight	D								
		Jan-Dec	---	---	---	---	None	---	None
1382831:									
Labette	C								
		Jan-Dec	---	---	---	---	None	---	None
Sogn	D								
		Jan-Dec	---	---	---	---	None	---	None
1382833:									
Tully	C								
		Jan-Dec	---	---	---	---	None	---	None

Table 21.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
1382834:									
Tully	C								
		Jan-Dec	---	---	---	---	None	---	None
1382835:									
Tully, eroded	C								
		Jan-Dec	---	---	---	---	None	---	None
1382836:									
Reading	B								
		January	---	---	---	---	None	Very brief	Rare
		February	---	---	---	---	None	Very brief	Rare
		March	---	---	---	---	None	Very brief	Rare
		April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		June	---	---	---	---	None	Very brief	Rare
		July	---	---	---	---	None	Very brief	Rare
		August	---	---	---	---	None	Very brief	Rare
		September	---	---	---	---	None	Very brief	Rare
		October	---	---	---	---	None	Very brief	Rare
		November	---	---	---	---	None	Very brief	Rare
		December	---	---	---	---	None	Very brief	Rare
1382837:									
Reading	B								
		January	---	---	---	---	None	Very brief	Rare
		February	---	---	---	---	None	Very brief	Rare
		March	---	---	---	---	None	Very brief	Rare
		April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		June	---	---	---	---	None	Very brief	Rare
		July	---	---	---	---	None	Very brief	Rare
		August	---	---	---	---	None	Very brief	Rare
		September	---	---	---	---	None	Very brief	Rare
		October	---	---	---	---	None	Very brief	Rare
		November	---	---	---	---	None	Very brief	Rare
		December	---	---	---	---	None	Very brief	Rare
1382839:									
Martin	C								
		Jan-Dec	---	---	---	---	None	---	None
1382840:									
Martin, eroded	C								
		Jan-Dec	---	---	---	---	None	---	None

Table 21.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
1382841:									
Martin, eroded	C								
		Jan-Dec	---	---	---	---	None	---	None
Gullied land.									
1382845:									
Zaar	D								
		January	1.5	>6.0	---	---	None	---	None
		February	1.5	>6.0	---	---	None	---	None
		March	1.5	>6.0	---	---	None	---	None
		April	1.5	>6.0	---	---	None	---	None
		May-Nov	---	---	---	---	None	---	None
		December	1.5	>6.0	---	---	None	---	None
1382846:									
Zaar	D								
		January	1.5	>6.0	---	---	None	---	None
		February	1.5	>6.0	---	---	None	---	None
		March	1.5	>6.0	---	---	None	---	None
		April	1.5	>6.0	---	---	None	---	None
		May-Nov	---	---	---	---	None	---	None
		December	1.5	>6.0	---	---	None	---	None
Dwight	D								
		Jan-Dec	---	---	---	---	None	---	None
1382849.									
Borrow pits									
1382850.									
Gravel pits and quarries									
1382851.									
Miscellaneous water									
1382852.									
Water									

Table 22.—Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Restrictive layer			Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Hardness		Uncoated steel	Concrete
		In				
1382809:						
Smolan	No restriction	---	---	Moderate	Moderate	Low
1382810:						
Chase	No restriction	---	---	High	High	Low
1382811:						
Ivan	No restriction	---	---	Moderate	Low	Low
1382812:						
Ivan	No restriction	---	---	Moderate	Low	Low
1382813:						
Kahola	No restriction	---	---	Moderate	Low	Low
1382816:						
Clime	Paralithic bedrock	20-40	Moderately cemented	Moderate	High	Low
Sogn	Lithic bedrock	4-20	Indurated	Moderate	Low	Low
1382818:						
Dwight	Lithic bedrock	40-60	Indurated	Moderate	High	Moderate
1382821:						
Florence	Lithic bedrock	40-60	Indurated	Moderate	Moderate	Low
Labette	Lithic bedrock	20-40	Indurated	Moderate	High	Low
1382822:						
Florence	Lithic bedrock	40-60	Indurated	Moderate	Moderate	Low
Matfield	No restriction	---	---	Moderate	Moderate	Low
1382823:						
Irwin	No restriction	---	---	Moderate	High	Low
1382824:						
Irwin, eroded	No restriction	---	---	Moderate	High	Low
1382825:						
Irwin	No restriction	---	---	Moderate	High	Low
1382826:						
Irwin, eroded	No restriction	---	---	Moderate	High	Low

Table 22.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer			Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Hardness		Uncoated steel	Concrete
		In				
1382827:						
Labette	Lithic bedrock	20-40	Indurated	Moderate	High	Low
1382828:						
Labette	Lithic bedrock	20-40	Indurated	Moderate	High	Low
1382830:						
Labette	Lithic bedrock	20-40	Indurated	Moderate	High	Low
Dwight	Lithic bedrock	40-60	Indurated	Moderate	High	Moderate
1382831:						
Labette	Lithic bedrock	20-40	Indurated	Moderate	High	Low
Sogn	Lithic bedrock	4-20	Indurated	Moderate	Low	Low
1382833:						
Tully	No restriction	---	---	Moderate	High	Low
1382834:						
Tully	No restriction	---	---	Moderate	High	Low
1382835:						
Tully, eroded	No restriction	---	---	Moderate	High	Low
1382836:						
Reading	No restriction	---	---	High	Moderate	Low
1382837:						
Reading	No restriction	---	---	High	Moderate	Low
1382839:						
Martin	No restriction	---	---	High	High	Low
1382840:						
Martin, eroded	No restriction	---	---	High	High	Low
1382841:						
Martin, eroded	No restriction	---	---	High	High	Low
Gullied land.						
1382845:						
Zaar	No restriction	---	---	---	High	Moderate
1382846:						
Zaar	No restriction	---	---	---	High	Moderate
Dwight	Lithic bedrock	40-60	Indurated	Moderate	High	Moderate

Table 22.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer			Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Hardness		Uncoated steel	Concrete
		In				
1382849. Borrow pits						
1382850. Gravel pits and quarries						
1382851. Miscellaneous water						
1382852. Water						

Table 23.—Taxonomic Classification of the Soils

Soil name	Family or higher taxonomic class
Chase	Fine, smectitic, mesic Aquertic Argiudolls
Clime	Fine, mixed, mesic Udorthentic Haplustolls
Dwight	Fine, smectitic, mesic Typic Natrustolls
Florence	Clayey-skeletal, smectitic, mesic Udic Argiustolls
Irwin	Fine, mixed, mesic Pachic Argiustolls
Ivan	Fine-silty, mixed, mesic Cumulic Hapludolls
Kahola	Fine-silty, mixed, mesic Cumulic Hapludolls
Labette	Fine, mixed, mesic Udic Argiustolls
Martin	Fine, smectitic, mesic Aquertic Argiudolls
Matfield	Clayey-skeletal, smectitic, mesic Pachic Paleustolls
Reading	Fine-silty, mixed, mesic Pachic Argiudolls
Smolan	Fine, smectitic, mesic Pachic Argiustolls
Sogn	Loamy, mixed, mesic Lithic Haplustolls
Tully	Fine, mixed, mesic Pachic Argiustolls
Zaar	Fine, smectitic, thermic Vertic Hapludolls

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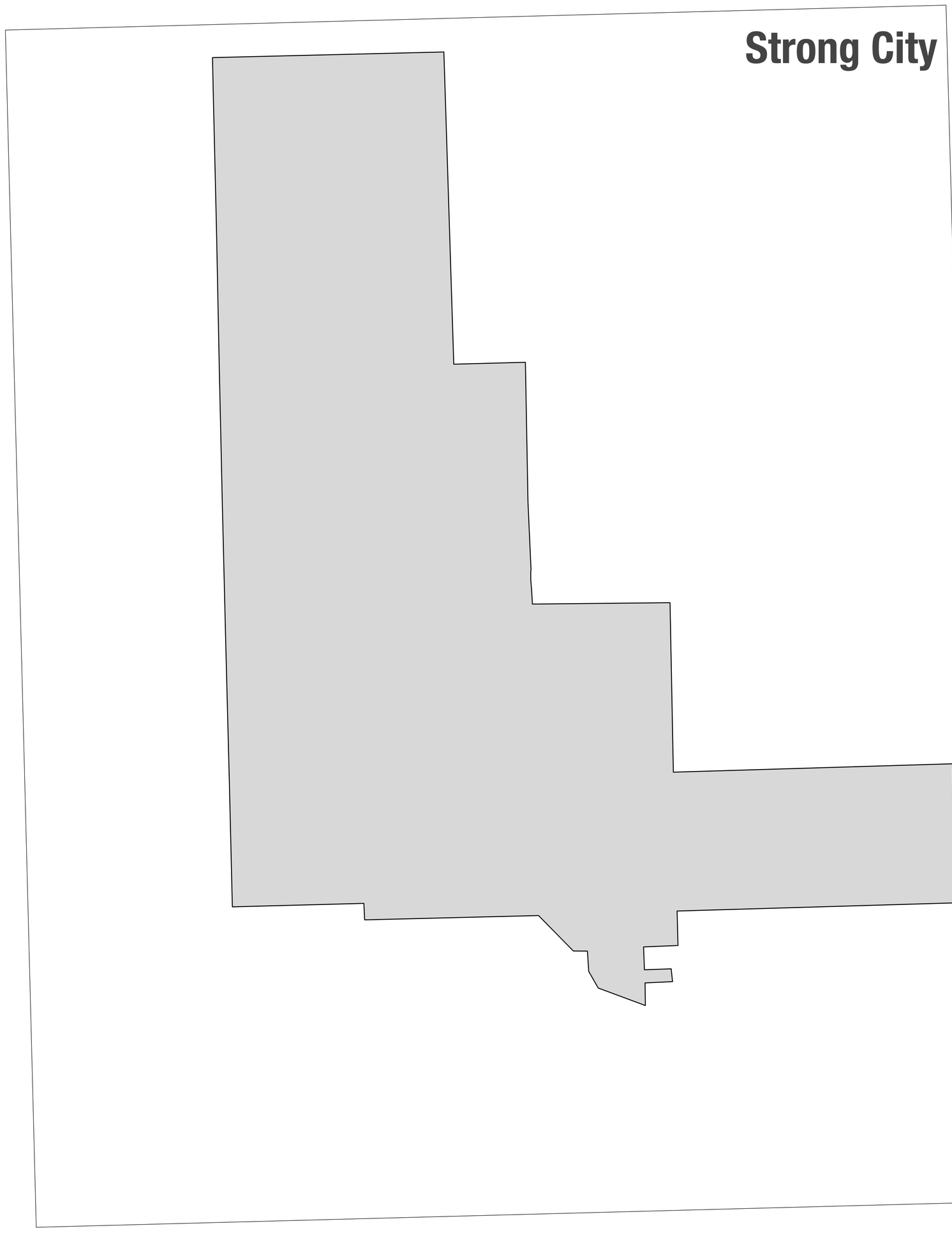


North

Scale 1:30,000
1 Inch = 0.76 Kilometers
0 1 2 3 Kilometers
0 1 2 Miles
1 Inch = 0.47 Miles

Park Boundary (2012)

USGS 24k Quadrangle

24k Quadrangle Name

INDEX TO MAP SHEETS Tallgrass Prairie National Preserve, Kansas

U.S. DEPARMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

MAP UNIT LEGEND TALLGRASS PRAIRIE NATIONAL PRESERVE, KANSAS

U.S. DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

SYMBOL	NAME
1382809	Smolan silty clay loam, 3 to 7 percent slopes
1382810	Chase silty clay loam, occasionally flooded
1382811	Ivan silt loam, channeled
1382812	Ivan silt loam, occasionally flooded
1382813	Kahola silt loam, rarely flooded
1382816	Clime-Sogn complex, 3 to 20 percent slopes
1382818	Dwight silt loam, 1 to 3 percent slopes
1382821	Florence-Labette complex, 2 to 12 percent slopes
1382822	Florence-Matfield cherty silt loams, 1 to 15 percent slopes
1382823	Irwin silty clay loam, 1 to 3 percent slopes
1382824	Irwin silty clay loam, 1 to 3 percent slopes, eroded
1382825	Irwin silty clay loam, 3 to 7 percent slopes
1382826	Irwin silty clay loam, 3 to 7 percent slopes, eroded
1382827	Labette silty clay loam, 1 to 3 percent slopes
1382828	Labette silty clay loam, 3 to 7 percent slopes
1382830	Labette-Dwight complex, 0 to 3 percent slopes
1382831	Labette-Sogn silty clay loams, 0 to 8 percent slopes
1382833	Tully cherty silty clay loam, 5 to 15 percent slopes
1382834	Tully silty clay loam, 3 to 7 percent slopes
1382835	Tully silty clay loam, 3 to 7 percent slopes, eroded
1382836	Reading silt loam, rarely flooded
1382837	Reading silt loam, 1 to 3 percent slopes
1382839	Martin silty clay loam, 3 to 7 percent slopes
1382840	Martin silty clay loam, 3 to 7 percent slopes, eroded
1382841	Martin-Gullied land complex, 3 to 10 percent slopes
1382845	Zaar silty clay, 3 to 7 percent slopes
1382846	Zaar-Dwight complex, 1 to 3 percent slopes
1382849	Borrow pits
1382850	Gravel pits and quarries
1382851	Miscellaneous water
1382852	Water

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF TALLGRASS PRAIRIE NATIONAL PRESERVE, KANSAS
STRONG CITY QUADRANGLE
SHEET NUMBER 1 OF 1

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service, at the request of the Department of the Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency from 2006 - 2011 aerial photographs. A 2012 National Park Service boundary was used. Soil information was derived from USDA/NRCS Soil Survey Geographic (SSURGO) database for Tallgrass Prairie National Preserve. Universal Transverse Mercator Zone 14 North, North American Datum of 1983 (NAD83).

NRCS Natural Resources Conservation Service

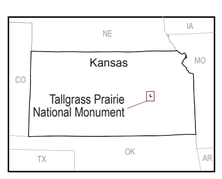
0 5,000 10,000
Feet

0 1 2 3
Kilometers

0 1 2
Miles

SCALE 1:24,000

North



Tallgrass Prairie
National Preserve,
Kansas

Sheet 1 of 1